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EDITED BY

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REVIEW OF SCIENCE AND INDUSTRY,

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VOL. VIII. AUGUST, 1884. NO. 4.

GEOGRAPHY.

ARCTIC CORPS OF EXPLORERS.

JOHN D. PARKER, U. S. A.

For centuries arctic exploration has elicited a wide-spread interest among many civilized nations. Icelanders, under a Norwegian captain, in the year 1000, discovered the American Continent, and sailed as far south as the coast of Massachusetts, which they named Vinland. Colonies were established by them on the Greenland coast, numerous churches planted, and profitable fisheries maintained for many years. Monuments were erected by this exploring party, on an island in Baffin Bay, where they were discovered in 1824. Since the early colonies of Icelanders and Northmen, in Greenland and Spitzbergen, perished, nearly all European nations, as well as Americans, have been more or less engaged in arctic exploration.

Arctic discovery has been prosecuted with vigor for several reasons. A mystery has hung over the polar regions which affects many departments of science. Evidence accumulates which indicates the existence of a vast polar sea. One branch of the Gulf Stream, composed of warm tropical waters, is known to set as an under-current into the Arctic Ocean, while a surface current flows in an opposite direction into the Atlantic Ocean. Immense icebergs have been seen drifting rapidly to the north against a strong surface-current flowing southward. These icebergs were evidently driven by a powerful under-current, as they extend in some instances two hundred feet above the surface of the sea,

and, if they are parallelopipeds, their depth below the surface would be seven times greater than their height above it.

Whales have been harpooned on the eastern side of the American Continent, in high latitudes, and have been captured, in some instances after a very short time had elapsed, on the western side, with the harpoons still in them, bearing the stamp of the ship, which is an indication of a northwest passage. The right whale is never found in tropical waters, and these harpooned whales could not, therefore, have passed around Cape Horn, or the Cape of Good Hope. Lieutenant DeHaven, who commanded the American expedition, in search of Sir John Franklin, when he arrived in high northern latitudes, saw far to the north a "water sky," which always indicates an open sea. Agassiz and other naturalists have noted the fact of the disappearance of immense numbers of whales into waters of very high latitudes just before the ocean was frozen over. As the whale is an air-breathing animal, and cannot live under the ice, its immigration northward must indicate an open polar sea. Water fowl have also been seen flying far to the north, as if they were seeking an open polar sea.

All of these indications prepared the world for the report which Dr. Kane brought back of an open polar sea north of the eighty-second parallel of latitude. After passing an ice barrier nearly one hundred miles wide where the spirit thermometer indicated a temperature of sixty degrees below zero, he came to the shores of an iceless sea, which extended toward the pole, in an unbroken sheet of water, as far as the eye could reach. As Dr. Kane approached the open water, he wrote: "We see its deep indigo horizon, and hear its roar against the icy beach. Its scent is in our nostrils and our hearts." Here the tides ebbed and flowed, and the waves dashed on the shore with the swell of a boundless sea. Probably the area of this polar sea may be shifted more or less by varying seasons, but it doubtless always remains open with a mildness of climate that would allow of human habitation.

Arctic discovery has been fruitful in various directions. It has enlarged our knowledge of the geography of the globe, and enabled us to construct our maps with much greater accuracy. Something has been gained in regard to the fauna and flora of the north polar region. We have been able to locate with some precision the magnetic pole, which is not without its value to navigation. Meteorology has received some contributions, and the aurora borealis has been studied in its native home. Some light has been thrown upon arctic geological formations, and our knowledge of the sea and its inhabitants has been enlarged. Ethnology has received valuable contributions by a comparative study of the various tribes of the Innuits, the raw fish-eaters, who are scattered over Greenland, Labrador, and the shores of the Arctic Ocean, and extend down the Pacific Coast as far as the Peninsula of Alaska, and also a portion of the adjacent Asiatic Coast. The missions established by the Moravians among the Innuits, about the middle of the last century, have been fruitful in important results to that superstitious people.

We should not be insensible to the benefits derived from arctic discoveries

in various directions. Knowledge is priceless, and science teaches that no fact is so insignificant as to be overlooked. But the results flowing from arctic discoveries have been purchased at a great sacrifice. Many valuable lives have been lost in the ice fields and floes of northern seas, great suffering have been endured, and an untold amount of property has been lavished on the expeditions. During the last eight centuries, probably not less than one hundred expeditions have been fitted out by national patronage, and private munificence. The larger portion have sailed in well equipped ships, while others have traversed the country on sledges. Science and art have been exhausted in fitting out these expeditions in the most elaborate manner, and nothing that could contribute to the ultimate success of the expeditions has been overlooked or wanting. The navies of the world have been stripped of their most sea-worthy vessels, and every appliance known to navigation has been supplied. Skill has been employed in the preparation of food for long voyages while ships might be locked in the ice. Cairns have been constructed in various places to preserve the records of lost expeditions, and caches located so that ship-wrecked mariners might not perish. These expeditions have been manned by the most distinguished navigators of all countries, and accompanied by experts in every department of natural science. We recognize the highest and most versatile talent in such men as the Cabots, Sir Hugh Willoughby, Martin Frobisher, John Davis, Henry Hudson, Von Wrangell, Lord Mulgrave, Captain Cook, Sir Alexander Mackenzie, Sir John Ross, Lieutenant Parry, Sir John Franklin, William Baffin, Sir George Back, Dr. King, Dr. Rae, Captain Penny, Lieutenant DeHaven, Lieutenant McClintock, Dr. Kane, Dr. Hayes, Captain Hall, Lieutenant DeLong, Captain Nares, Nordenksjöld, Lieutenant Frederick Schwatka, and many others. Their ships have vexed the Arctic seas, encountered icebergs, wrestled with floes, drifted in the frozen ice, and their sledges have tracked the frozen fields of the north, or been covered with accumulating drifts. Exploring parties have been days without food, eating their old shoes and scraps of leather, subsisting at last on rock tripe and mosses, sleeping with a single blanket and deer-skins, with the spirit thermometer 57° below zero, and have dragged their canoes and sledges over the snow until they have dropped down from sheer exhaustion, and multitudes have left their bones to bleach under the snows of Arctic lands.

When Arctic exploration seemed destined to prove a comparative failure, Capt. H. W. Howgate proposed to establish a colony of fifty persons, on the shores of Lady Franklin Bay, where they would be supplied with fuel from a seam of coal lately discovered. This Arctic colony was to be provisioned for three years, and another smaller colony was to be established at Cape Union about ninety miles farther north, and the two colonies connected by telegraph. The world is now witnessing an expedition sent out to relieve Lieutenant Greely whose safety is problematical.[1]

Amidst such unparalleled hardships and sufferings, on the part of Arctic explorers, of nearly all civilized nations, we cannot wonder that the world is becoming a little weary of Arctic exploration, and many are asking, "Why is all

1 Written before the news of Lieut. Greely's rescue had been received.—[ED. REVIEW.

this loss of life and waste of treasure?" In view of these things, it is the purpose of this paper to propose a new plan of Arctic exploration, which will not endanger life to any considerable extent, or cost much public patronage, but will perhaps secure more important results than have hitherto been obtainable. It is proposed that our Government, with the coöperation, if possible, of other civilized nations, turn over this whole business of Arctic exploration to an Arctic corps of explorers, composed of native Innuits, who should be secured, educated and employed by the Government, under the command of an American naval officer, in the following manner: Let our Government secure through the auspices of the Moravian missionaries, laboring among the Innuits, twenty or more of the young men of that people who have arrived at the age of eighteen or twenty years. The age fixed upon should be the time of life when their physical nature has become accustomed to the rigors of an Arctic climate, while the mind is still in a receptive condition. Sufficient inducements should be offered these young men to become cadets at the Naval Academy, where they should be instructed in the English language, and given a regular naval education. If difficulty is experienced in obtaining the whole corps of Innuits at first, secure one and educate him, and the way would doubtless be opened to obtain as many Innuits as were wanted, upon whom would gradually dawn the possibilities of a new life. These native Innuits, as soon as they could comprehend the project, would undoubtedly respond with alacrity, to the universal call, to explore their native country, and to dissolve the mists which have hung over the polar regions so many centuries. Let these young men be employed in the navy, as the Arctic Corps of Explorers, and put under the command of some naval officer, of hardy constitution, like Captain Hall. By adopting as far as necessary methods of living employed by the Innuits, supplemented by improvements offered by civilization, such a corps would be enabled to prosecute Arctic exploration under the most favorable auspices possible. They would possess the personal qualities demanded by the rigors of an Arctic climate, be familiar with the methods of living adopted by the natives, supplemented by improved methods, and possess for their work of exploration the knowledge and equipments of modern scientific research. Let the Government build a vessel adapted to Arctic exploration, and furnish it with all the necessary equipments. Sledges could be used in high latitudes, and the work could be carried on systematically over a period of years, long enough to solve all the questions of the Arctic regions which have been studied at such a disadvantage and sacrifice of life and property, by nearly all civilized nations, for the last eight centuries. Possibly the ice barrier surrounding the polar sea could be passed, and a vessel launched on that mysterious ocean, whose tides have ever beaten on unknown shores, where science would reap an abundant harvest, whose circles of facts have ever been broken in polar seas. The captain, the prow of whose proud ship plowed the waves of the Arctic sea beneath the very pole, would have unlocked the mysteries of this unknown region, and brought some compensation to the nations whose efforts have been baffled for centuries, and whose mariners lie unburied in many Arctic lands. Other

enlightened nations might desire to share in the expenses of such an exploration, conducted on natural and common sense principles, and be entitled to reap mutual advantages.

The Arctic corps of explorers could be kept full, by enlisting and training other young Innuits, as the demands of the service might require. When the mysteries which have hung over the north pole so many centuries have been solved, and the possibilities of that unknown region been determined and utilized for civilization, the Arctic corps of explorers could be transformed into an Antarctic corps of explorers, who could apply their skilled powers in solving the mysteries of the south polar region which are as great perhaps as those of the opposite pole.

The Innuits, as a people, possess the natural qualities necessary for Arctic exploration. They are a very hardy race, and nature has given them peculiar qualities for enduring the rigors of an Arctic climate. Crantz describes those living in Greenland as "small but well proportioned, broad shouldered, generally less than five feet high, with high cheek bones, flat faces, small, lusterless black eyes, round cheeks, small flat noses, small round mouths, long, straight, coal-black hair, large heads and limbs, and small, soft hands and feet." They are a hardy, active, industrious and ingenious race, and show great skill in the construction of their boats and sledges, weapons and utensils. Their dwellings are located near the shore, as they subsist mostly on raw fish, and are constructed of snow, ice or stone, cemented by turf, and covered by a flat roof of wood or turf. Frobisher and Parry describe some of their houses which were built of the bones of whales and walruses. In the preparation of their dress, which consists principally of furs, they exhibit a degree of ingenuity greater than that of the most skillful furrier. Their small boat for men is remarkable for its speed and beauty, and the Innuit has such control over it that he can defy the storms of ocean, and has such daring that he does not hesitate in his *kayak* to approach and give battle to the polar bear, or the monsters of Arctic seas. They hunt with bows and arrows, spears and slings, carve on ivory or walrus tusks with much skill, and are scrupulously honest among themselves. There can be no doubt, that under the influence of modern civilization, these Innuits could be educated and inspired to execute polar exploration at a minimum cost of life and treasure, and a maximum of all possible results desired in modern times. Such a corps of Arctic explorers, skilled in the methods and results of modern scientific research, and imbued with the spirit of the nineteenth century, would not be without their influence in diffusing better ideas among the various tribes of Innuits scattered through the Arctic regions, and give them the pulses of a new life.

This new plan for Arctic exploration is offered, with some degree of hesitancy, for the consideration of Arctic explorers, in the hope that although some objections seem to lie against it, still it may contain the germ of a new plan of exploration which may be developed in the skillful hands of explorers, to accomplish all desirable results, and still save the further great loss of life and treasure, which nearly all civilized nations have suffered for more than eight hundred years.

RESCUE OF THE GREELY EXPEDITION.

COMPILED BY THE EDITOR.

On July 17th the thrilling news was received at the War Department in Washington City, D. C., of the rescue on June 22d of the survivors of the Greely expedition which left the United States in 1881, and in regard to whose fate the most lively apprehensions have existed for the past year or more. This news was, however, extremely depressing, since out of the twenty-five persons comprising the original party only seven were found alive, one of whom (Ellison), died soon after the discovery, from the effects of an operation necessitated by his disabled condition.

The following are the dispatches received at the War Department:

ST. JOHNS, N. F. 9 A. M., July 17th.

To HON. WM. E. CHANDLER, Secretary of the Navy, Washington:

The Thetis, Bear and Loch Garry arrived here to-day from West Greenland, all hands well. They separated from the Alert 150 miles north during a gale at 9 P. M., June 22d, five miles off Cape Sabine, in Smith's Sound. The Thetis and Bear rescued alive Lieut. A. W. Greely, Sergeant Brainard, Sergeant Fredericks, Sergeant Long, Hospital Steward Beiderback, Private Connell and Sergeant Ellison, the only survivors of the Lady Franklin Bay expedition. Sergeant Ellison had lost both hands and feet by frost bite, and died July 6th, at God Haven, three days after amputation, which had become imperative. Seventeen of the twenty-five persons composing the expedition perished by starvation at the point where they were found. One was drowned while sealing to procure food. Twelve of the bodies of the dead were rescued and are now board the Thetis and Bear. One, the Esquimo Turnevick, was buried at Disco in accordance with the desire of the inspector of Western Greenland. Five bodies buried in the ice near the camp were swept away to sea by the winds and currents before my arrival and could not be recovered. The names of the dead recovered, with date of death, are as follows: Sergeant Cross, January 1, 1884; Wederick, the Esquimo, April 5; Sergeant Linn, April 6; Lieutenant Lockwood, April 9; Sergeant Rice, April 9; Corporal Salem, June 3; Private Bender, June 6; Assistant Surgeon Pavy, June 6; Sergeant Gardner, June 12. Drowned by breaking through the ice while sealing, Jens Edwards, an Esquimo, April 24.

I would urgently suggest that the bodies now on board be placed in metallic cases here for safer and better transportaion in a sea-way. This appears to me imperative. Greely abandoned Fort Conger August 9, 1883, and reached the Baird inlet September 29, following, with the entire party well. He abandoned all his boats and was adrift thirty days on the ice-floe in Smith's Sound. His permanent camp was established October 21, 1883, at the point where he was found. During nine months his party had to live upon a scant allowance of food brought

from Fort Conger that was cached at Prayer Harbor and Cape Isabella by Sir George Nares in 1875, but was found much damaged by the lapse of time; also on that cached by Beebe at Cape Sabine in 1882, a small amount saved from the wreck of the Proteus in 1883 and landed by Lieuts. Garlington and Colwell on the beach near where Greely's party was found. When these provisions were consumed the party was forced to live on boiled sealskin stripped from their sealskin clothing and lichens and shrimps caught in good weather when they were strong enough to make the exertion. As it took 1,300 shrimps to fill a gallon measure the labor was too exhausting to depend upon them to sustain life entirely. The channel between Cape Sabine and Littleton Island did not close, on account of violent gales, all winter, so that 240 rations at that point could not be reached.

All of Greely's records and all of the instruments brought by him from Fort Conger were recovered and are on board. From Hare Island to Smith's Sound I had a constant and furious struggle with the ice in impassable places. The solid barriers were overcome by watchfulness and patience. No oportunity to advance a mile escaped me, and for several hundred miles the ships were forced to run their way from lead to lead through ice varying in thickness from three to six feet, and when rafted much greater. The Thetis and Bear reached Cape York June 18, after a passage of twenty-one days in Melville Bay, with two advance ships of the Dundee whaling fleet, and continued to Cape Sabine, returning seven days later. We fell in with seven others of this fleet off Wostenholme Island and announced Greely's rescue to them, that they might not be delayed from their fishing grounds nor be tempted into the dangers of Smith's Sound in view of the reward of $25,000 offered by Congress. Returning across Melville Bay we fell in with the Alert and Lock Garry off Devil's Thumb struggling through heavy ice. Commander Coffin did admirably to get along so far with the transport so early in the season before the opening had occurred.

Lieutenant Emery with the Bear has supported me throughout with great skillfulness and unflinching readiness in accomplishing the great duty of relieving Greely. The Greely party are very much improved since their rescue, but were critical in the extreme when found and for several days after. Forty-eight hours delay in reaching them would have been fatal to all now living. The season in the north is late and the coldest for years. Smith's Sound was not open when I left Cape Sabine. The winter about Melville Bay was the most severe for twenty years. This great result is entirely due to the unwearied energy of yourself and the Secretary of war in fitting out this expedition for the work it has had the honor to accomplish.

[Signed] W. S. SCHLEY, Commander.

General Hazen, Chief Signal Officer, received the following telegram:

ST. JOHNS, N. F., July 17th.—For the first time in three centuries England yields the honor of penetrating farthest north. Lieutenant Lockwood and Sergeant Brainard, May 13, reached Lockwood Island, latitude 83° 24″, longi-

tude 44° 5″. They saw from 2,000 feet elevation no land to the northwest, but to the northeast Greenland yet extended, lost to view in Cape Robert Lincoln, latitude 83° 35″, longitute 38°. Lieut. Lockwood was turned back in 1883 by open water on the North Greenland shore, the party barely escaping drifting into the polar ocean. Dr. Parry, in 1882, following the Markham route, was adrift one day in the polar ocean north of Cape Joseph Henry and escaped to land, abandoning nearly everything. In 1882 I made a spring, and later a summer trip into the interior of Grinnell Land, discovering Lake Hazen, some sixty by ten miles in extent, which is fed by ice. The Cape of North Grinnell Land drains Ruggles River and Weyprecht fiord into Conybear's Bay and Archer fiord.

From the summit of Mount Arthur, 5,000 feet, the contour of the land west of Conger Mountain convinced me that Grinnell Land tends directly south from Lieut. Aldrich's farthest trip in 1876. In 1883 Lieut. Lockwood and Sergeant Brainard succeeded in crossing Grinnell Land, and ninety miles from Beautux Bay, the head of Archer's fiord, struck the head of a fiord from the Western Sea, temporarily named by Lockwood, Greely fiord. From the center of the fiord, in latitude 80° 30′, longitude 78° 30′, Lieut. Lockwood saw the northern shore termination some twenty miles west, the southern shore extending some fifty miles with Cape Lockwood some seventy distant, apparently separate land from Grinnell Land. He named the new land Arthur Land. Lieut. Lockwood followed, going and returning, an ice cape averaging about 150 feet perpeendicular face. It follows that Grinnell Land in the interior is ice-capped with a belt of country some sixty miles wide between the northern and southern ice capes. In March, 1884, Sergeant Long, while hunting, looked from the northwest side of Mount Carey to Hayes' Sound, seeing on the northern coast three capes westward of the farthest seen by Nares in 1876. The sound extends some twenty miles farther west than shown by the English chart, but is possibly shut in by land which showed up across the western end. The two years station duties, observations, all explorations and the retreat to Cape Sabine were accomplished without loss of life, disease, serious accident or even severe frost bites. No scurvy was experienced at Conger and but one death from it occurred last winter.

[Signed] GREELY, Commanding.

A second dispatch from Lieutenant Greely was as follows:

ST. JOHNS, July 17th.

CHIEF SIGNAL OFFICER, Washington:

Brainard, Biederback, Connell, Fredericks, Long and myself, sole survivors, arrived to-day, having been rescued at the point of death from starvation by the relief ships, Thetis and Bear, June 22, at Camp Clay, northwest of Cape Sabine. All are now in good health, but weak. Sergeant Ellison was rescued, but died July 6. Cross died last January; Christiansen, Linn, Rice, Lockwood, Jewell and Edwards in April; Ellis, Ralston, Whistler, and Israel in May; Kislingbury Salor, Henry, Bender, Pavy, Gardner and Schneider in June. We abandoned Fort Conger August 9, were frozen in a pack off Victoria Head August 29,

abandoned the steam launch September 11, eleven miles northeast of Cocked Hat Island. When on the point of landing we were three times driven by southwest storms into Kane's Sea. We finally landed September 29 in David Inlet. Learning by scouting parties of the Proteus disaster and that no provisions had been left for us from Cape Isabella to Sabine, we moved and established winter quarters at Camp Clay, half way between Sabine and Cocked Hat. An inventory showed that daily rations of four and one-third ounces of meat, seven ounces of bread and dog biscuits, and four ounces of miscellaneous food, the party would have ten days full rations left for crossing Smith's Sound to Littleton Island. Unfortunately Smith Sound remained open the entire winter, and crossing was impracticable. Game failed despite daily hunting from early in February. Before the sun returned only 500 pounds of meat was obtained this year. Minute shrimps, sea weed, sassafras, rock lichens, and sealskin were resorted to for food, with results as shown by the number of survivors. The last regular food was issued May 14. Only 150 pounds of meat was left by Garlington, which compelled me to send on November 4 men to obtain 144 pounds of English meat at Isabella. During the trip Ellison froze both hands and feet and lost them all; surviving, however, through our terrible winter and spring, until July 6. The survivors owe their lives to the indomitable energy of Captain Schley and Lieut. Emery, who, preceded by three, and accompanied by five, whalers, forced their vessels from Upernavik, through Melville Bay into Northwater, at Cape York, with the foremost whaler. They gained a yard whenever possible, and always held it. Smith's Sound was crossed and the party rescued during one of the most violent gales that we have ever known. The boats were handled only at the risk of swamping. Four of us were then unable to walk, and could not have survived exceeding twenty-four hours. Every care and attention was given us. We saved and bring back copies of meteorological, tidal, astronomical, magnetic, pendulum and other observations, also pendulum and standard thermometers, forty-eight photographic negatives. A collection of blanks and photographic proofs, Esquimo relics and other things were necessarily abandoned. The Thetis remains here five days probably.

[Signed] GREELY, Commanding.

The following despatch was sent Lieutenant Greely in reply:

SIGNAL SERVICE OFFICE, July 17.

LIEUTENANT A. W. GREELY, St. John:

Our hearts are flowing with gladness and thanks to God for your safety, and in sadness for those who without fault of yours are dead. Your family are well and at San Diego.

W. B. HAZEN.

The news of the rescue of Lieutenant Greely created much excitement in Washington City. The telegram from Commander Schley was received by Rear Admiral Nichols, acting Secretary of the Navy, who immediately communicated its contents to Lieutenant-General Sheridan, acting Secretary of War. They pro-

ceeded to the White House and showed the telegram to the President, who has taken deep interest in the expedition and who expressed great concern at the sad death of so many of the party. A copy of the telegram was telegraphed to Secretary Chandler at West Point, and to Secretary Lincoln at New York. The families of Lieut. Greely, Lieut.-Commander Schley and Lieut-Emery were also informed of their rescue. Rear Admiral Nichols to-day telegraphed Commander Schley at St. Johns, as follows: "Use your discretion about the care and transportation of bodies. Report by wire when ready to sail for New York. The department sends most hearty congratulations to yourself, officers and men."

The following despatch was forwarded by Secretary Chandler from West Point:

COMMANDER W. S. SCHLEY, St. Johns, N. F.:

Receive my congratulations and thanks for yourself and your whole command for your prudence, perseverance and courage in reaching our dead and dying countrymen. The hearts of the American people go out with great affection to Lieut. Greely and the few survivors of his deadly peril. Care for them unremittingly, and bid them be cheerful and hopeful on account of what life has yet in store for them. Preserve tenderly the remains of the heroic dead, prepare them according to your judgment, and bring them home.

[Signed] W. E. CHANDLER, Secretary of the Navy,

The following telegram was also sent:

LIEUTENANT GREELY, St. Johns:

Your dispatches are most satisfactory and show your expedition to have been in the highest degree successful in every particular. This fact is not affected by the disaster later.

W. B. HAZEN.

On arrival at the anchorage of the relief squadron an associated press correspondent interviewed Lieut. Greely and other survivors of the Arctic colony. The followidg facts were disclosed: After passing two winters at Fort Conger in scientific researches, Lieut. Greely, with his whole party intact, broke up their encampment and commenced a southward descent. This was accomplished amid great perils from gales of wind, ice nips and other casualties. Cape Sabine having been reached, a temporary home was erected, built of stone and covered by the boats' sails brought along by the party. On the 29th of September winter quarters were established at Cape Sabine. The commissariat had become very meáger, and the cache of provisions left by the Proteus last year but poorly supplemented it. The steam launch had become fast on the ice a few weeks previous and had to be abandoned during the whole winter.

The first havoc in the ranks was early in January, when one of the men dropped off with scurvy. On the 9th of April Lieut. Lockwood and Mr. Rice, the photographer, succumbed after a heroic attempt to secure for their starving comrades about 200 pounds of meat supposed to be cached at a place named Bad Creek, distant about fifteen miles from the encampment. Israel, the astro-

nomer, perished May 27th; L. Kislingbury died June 1st, and Dr. Pavy, the naturalist, slept in death June 6th. Not one of the victims realized that death was so near. They all died a tranquil, painless death. Two Esquimaux also perished; one of starvation, the other drowned, his kayak being pierced by some newly formed ice April 17th, thus cutting off all prospecting for a supply of seal meat for the starving explorers. The Esquimaux were most faithful and devoted followers and helpers of Lieut. Greely. Ellison was rescued and safely brought on board the steamship Bear, where he died a few days subsequently. His is an extraordinary instance of human endurance. While away some ten miles from his hut last winter the temperature suddenly dropped 48° below zero. His hands and feet were frozen to the very bone, and he was dragged by his comrades in an almost dying condition to his hut. His feet and hands were literally amputated by the incisive frost, and in this terrible state he lived through the dismal months that intervened between that time and the rescue.

The bodies of twelve of the victims have been brought up by the steamers Bear and Thetis, embalmed in tanks filled with alcohol. The survivors are all doing well and rapidly gaining flesh and strength. Lieut. Greely, who was in an exceedingly critical condition when transferred to the Thetis, is now able to move about. This morning he drove out for an hour's ride to get the country air and came back quite recuperated.

The rescue took place on the 22d of June under circumstances of great difficulty. The Thetis and Bear lay off from the shore about three hundred yards. There was a terrific gale blowing from the southwest, a heavy sea was running, and a formidable ice nip was apparently inevitable. Lieut. Greely and the other six survivors had to be transferred from their camp to the steam launch and whale boat in their sleeping bags, and while steaming from land to the ships the destruction of the whole party at one time seemed certain. The sea swept furiously over them, and the fury of the wind threatened at every instant to capsize them.

At length they were safely placed on board the rescuing squadron, where every possible preparation had been made to secure their recovery. The Greely party reached the highest latitude ever yet reached by polar explorers, namely, 83° 25 5-10′. The coast of Greenland was carried up to 85° 35′, by observation, and named Cape Lincoln. The steamship Alert parted company with the squadron yesterday off Turk Island and has not yet reached port.

It was discovered during the past winter by Lieut. Greely that Cape Sabine was part of an island, not the mainland, as was thought by previous geographers. It is separated from the mainland by a narrow creek, now called Rice's Strait, in memory of the dead photographer. Lieut. Greely informed a correspondent that a large body of valuable scientific work had been done during the two seasons spent at Fort Conger by himself and his lieutenants. About 2,500 miles of exploration had been effected and many valuable observations, magnetic, thermometeric and meteorologic had been made. The winter of 1881 was the severest of the three. The mean of the thermometer during February was 48° below

zero. Seals were observed as high up in latitude as 81° and 8°. Several varieties of ducks were observed and a variety of other birds known and unknown to ornithologists. Over 100 musk-oxen were slaughtered during the two weeks' residence at Fort Conger. Their flesh proved very valuable food, being palatable, wholesome and nutritious. The whole official work of the expedition, plans, sketches and photographic plates and scientific sketches, have been saved and brought home by Lieut. Greely.

Sergeant Long, of the Greely party, who was the first to respond to the welcome tone of the steam whistle, says he and Sergeant Brainard were first to hear the sound and they helped each other to crawl out of the tent. When Long got clear of the entanglement of the tent, which had been swept to the ground, he rose to his feet with great difficulty and succeeded in clambering up to the rock that gave the most extensive view in that neighborhood, and Brainard went back to the tent, but Long remained looking out searchingly in every direction for some strange object. At length he saw the unwonted sight of a large black object about a mile distant, which at first looked like a rock, but he knew there was no rock in that line. Suddenly the approaching steam launch changed its course and Long recognized the approach of the rescuers.

He came down from the rock. went toward the camp, raised the flag pole and flag which had been blown down during the gale and held it for about two minutes—until his strength gave out and it was blown once more to the ground. He then advanced totteringly in the direction of the little steamer and in a few minutes the warm hand of Captain Ash had grasped his in greeting.

Maurice Connell, who is still excessively weak, stated in an interview that for some days after his rescue he had no recollection of anything that transpired. He did not hear the awakening scream of the whistle and when his comrades shook him up from his prostrate position in camp and told him succor was at hand, he wildly exclaimed "for God's sake let me die in peace!" A teaspoonful of brandy applied to his lips called back the fleeting life-spark, for Connell could not have survived more than a few hours. He was by far the weakest of the seven survivors, and the strongest must have succumbed within forty-eight hours.

The story told by Connell from his recollection of their starving experience is simply heartrending. How they burned the hair off their sealskin boots and coats, cut them into strips, boiled them into stew and ate voraciously of them till their stomachs rebelled and nausea and weakness ensued. In several cases nature gave no call for twelve, fifteen and even eighteen days, and then bloody hemorrhage and consequent weakness ensued, prostrating the victim for several days. The difficulty of keeping the heat in the body was very great. The rule of the camp was to permit no one to sleep longer than two hours. He was awakened roughly and called upon to shake himself, beat his hands and pound his feet and restore circulation. This was found absolutely necessary to prevent torpor and possibly death, the usual accompaniments of intense cold.

Commander Schley has received instructions from the Secretary of the Navy

to remain at St. Johns until there are twelve iron caskets constructed to receive the bodies of the deceased explorers. The survivors are all doing well, but are still weak and suffering from nervous prostration. Lieut. Greely has improved from 120 pounds, his weight on the 22d of June, to 169 pounds. Sergeant Brainard and others are pulling up proportionately. The weather here is delightful, and all that could be desired for the sufferers, the mercury ranging between 65° and 75°. Great sympathy is evinced by all classes here, alike for the survivors and the dead, and every token of respect is manifested for them.

The Thetis and Bear as they ride quietly at anchor in the harbor of St. Johns wear a somber and mounful appearance, with the flag of the United States at half mast. The United States war ship Alert arrived here at 8 P. M. Her detention was caused by fog and search for the other ships of the squadron. All on board are well.

Sergeant Julius R. Fredericks relates a mournfully tragic story of the sad death on the ice covered ground of George Rice, the artist of the expedition. April 6th Rice and Fredericks volunteered to leave camp to proceed a distance of twenty-five miles for some meat that was cached near Cape Isabella. They had a sled, rifle and hatchet and provisions for five days. They traveled for three days, but failed to find the cache. On their way to camp, Rice became weak and finally gave up. He was attacked by bloody flux that gradually wore him down. He succumbed and was interred in an ice grave by his companion. Fredericks camped out that night under the fragment of a boat and next day revisited his companion to pay his last tribute to his remains. Fredericks retained sufficient strength to drag back the sled with the hatchet, rifle and cooking utensils to the camp, where he encountered more woe in the form of the death of Lieutenant Lockwood, another of the party. The cached meat that Fredericks and Rice were in search of was brought by them April 6th, from Cape Isabella and abandoned next day in order to drag Ellison, one of their party who had been frozen, into camp. Rice was the life of the Greely party, full of hope, buoyancy and energy, and his death was a terrible blow to them. He died in a brave struggle to prolong their existence.

Meager as the news is of the details of the rescue, the fearful mortality of the little colony in its endeavors to escape from exile, tells a story of hardships and suffering that needs no elaboration.

The party was rescued at Cape Sabine in latitude 79° and opposite Littleton Island, near where the Proteus sank last year, en route to rescue the Greely colony at Lady Franklin's Bay, in latitude 82°. The long journey over a trackless waste of snow and ice, with great glaciers to traverse, between Lady Franklin's Bay and Cape Sabine, must have been full of toil and suffering, with many examples of heroic fortitude and endurance, for it is understood the whole party reached Cape Sabine in safety.

There the great sufferings began, for the borean blast of the polar region kept the sea open, and being without boats Littleton Island could not be reached, where provisions were cached the year previous by the ill-fated Proteus expedition.

Starvation sat in, and famine, combined with exposure, took one after the other off, until seven only of the twenty-five picked men for this polar expedition were left to tell the story of the last Arctic tragedy.

Besides Lieut. Greely there were two other commissioned officers and a surgeon, and of these Lieut. Greely alone survives, the other survivors being enlisted men.

It is strange, or appears so to the writer, that Lieut. Greely, whom he knew well, should have been one of the survivors. He was not a strong man, or robust in appearance. He is about six feet tall, slender, rather delicate in appearance, and very nearsighted. He is the last man any of his acquaintances would have thought would volunteer for such perilous service, and having volunteered, it was believed he never would survive the hardships.

First Lieutenant Greely, of the Fifth Cavalry, became fired with zeal and enthusiasm about the meteorology of the polar regions through his connection with the Signal Bureau of the army, and he was led even before he started on this expedition to volunteer to go out in the Gulnare, a vessel Captain Howgate, of the Signal Service, had fitted out for polar exploration, but which was condemned as unseaworthy before she set sail. Lieut. Greely's survival is fortunate, aside from the gratification we must all feel because of the rescue of so gallant an officer, because if the two years' residence in the Arctic regions has developed anything beneficial to science, Lieut. Greely will be most competent to impart it.

The loss of the others will be deeply deplored, while all must rejoice over the salvation of the few.

One of the most prominent, and decidedly the most enthusiastic member of the Greely party, was Dr. Octave Pavy, a citizen of Missouri, who died of starvation on June 6th of this year. The Doctor was born in France, June 22, 1845, and did not come to America until just before the close of the Franco-Prussian war. He was a gentleman of high attainments, a ripe scholar, skillful surgeon, facile writer and genial companion. He was almost a monomaniac on the subject of polar explorations and for several years acted as Private Secretary for Lambert, the renowned French scientist and explorer, also an enthusiast on Arctic discoveries. He imbued the young Frenchman with the same spirit for research in the regions of the frozen North. Lambert had received assurances from the French Government that an expedition would be fitted out to go to the Arctic circle, of which he was to receive command, and Pavy would have been one of his associates, but the Franco-Prussian war put an end to the proposed expedition.

In 1878 Dr. Pavy married Miss Lilla Stone, the daughter of a minister at Lebanon, Ill., an estimable and talented lady who encouraged her husband in his cherished designs. For two years and a half Mr. and Mrs. Pavy resided in St. Louis, and he was employed for some time as physician in the Meyer Iron Works. The unfortunate Frenchman talked constantly about a trip to the pole, and it was through Lieut. J. H. Weber, of the United States Signal Service in St. Louis, that he was brought into communication with Captain Howgate, which

resulted in his engagement as surgeon and naturalist on the Gulnare, and his subsequent addition to the ill-fated Greely party. The widow of Dr. Pavy is residing at Maryville, Mo., where she has been conducting a select school for young ladies. The deceased had a number of friends in St. Louis, who regret that he came to such a terrible death. A movement was started on 'Change, in St. Louis, by D. R. Francis, Michael McEnnis, Ewing Hill, Seth Cobb and other prominent merchants, to raise a fund for the support of the heroic wife of Dr. Pavy, who has been left in embarrassed circumstances. It is urged in behalf of the subscription that Dr. Pavy was the only member of the Greely expedition who resided in Missouri, and it would be a graceful compliment to the worthy widow and a mark of respect to the dead, were a liberal sum presented to her with the best wishes of the people of St. Louis and Missouri.

Until Lieut. Greely's reports are made public this polar expedition cannot be declared a failure, but the disposition is to entertain the belief that nothing can be learned behind the ice barriers of the north that will compensate for the sufferings every polar expedition has entailed and the loss of life all have caused.

The "open polar sea" is as much of a mystery as ever. A great majority of navigators and men of science are convinced that the northern hub of the universe is surrounded by solid ice, and yet one of Lieut. Greely's dispatches intimate that there really is open water up in that region, as the minority claim. In a year or two, we suppose, after Greely's discoveries have been published and suggested, somebody will propose fitting out another expedition to solve the problem. The scientific results, if any, accomplished by the colony at Lady Franklin Bay are yet to be made known.

As barren and destitute of the means of sustenance as Lieut. Greely found the polar region, there is a well defined theory among scientists that life began at the poles. The theory is that the poles were at first fitted to produce life, which consequently began at the northern and southern extremities of the globe, developing independently, but to a certain extent correspondingly, as the conditions were similar. By the secular cooling of the earth the poles finally became unfitted to support life, and such forms as did not perish in the changes of the earth's surface slowly migrated toward the equator, changing in the course of years, and ultimately giving rise to a fauna which over the most of the globe consists of a mixture of northern and southern forms.

Many facts derived from the Northern Hemisphere lend support to this theory, and the Southern Hemisphere is adding facts to confirm the theory. The animals of the Northern Hemisphere are almost identical throughout the world's circuit. The same families and even the same species of mammals and birds are common to the North in the Old and New World. The elk, reindeer, the beaver, lynx, fox, and wolf, for instance, of the Old World are specifically identified with those of the New.

Remains of animals now regarded as tropical, such as the elephant, hippopotamus, lion, etc., are common in the tertiary strata of temperate and even the polar regions. This is proof of a southern migration when the climate changed.

In Patagonia remains of mammals are found which tend to show that the fauna of Patagonia preceded that of the Argentine Republic, and, moreover, the animals of South America have their counterpart in Australia and Africa. The flora of the Southern Hemisphere in the Old and New Worlds correspond, and the fossil remains in the Eastern and Western Hemispheres correspond around the world's circuit. These resemblances become more marked when fishes, insects, and the mollusca of the Old and New Worlds are considered.

At least one result gratifying to our national vanity has been accomplished by the polar expeditions from the United States within the last fifteen years—the geography of the Arctic regions has been enriched by a great many familiar American names. The English for a long time had a monopoly of this nomenclature, and the names of their great explorers, naval commanders, reigning princes, and some of their "sisters, cousins, and aunts," are perpetuated in the gulfs, straits, channels, capes, headlands, and islands of the polar seas. The expedition of Captain Hall, and the two years' residence of Lieut. Greely in the upper polar regions, has given to some of the prominent men of our own country a place in Arctic geography.

Cape Robert Lincoln at present overtops all the designated points on the polar map. It is in north latitude 83° 35′, longitude 38°. It may be a century before the explorers of any other land carry a historic name nearer to the pole. Lockwood Island, named in honor of the gallant young soldier who discovered it, is in latitude 83° 24′, and this may for many years remain one of the extreme outposts of Arctic discovery. Arthur Land is not quite so far away, but still it is some thousands of miles too near the Pole to be an agreeable place of residence. We have Hayes Sound, Greely Fiord, Cape Joseph Henry, Hazen Lake, and many other titles that bring before us the men of our own generation, whose names have been used to designate land-marks and water marks on the way to the Pole.

The admirable dispatches from St. John's give a most interesting account of the operations of Lieut. Greely's party during their two years' stay at Fort Conger, and of the mode of living at a hyperborean station. Astronomical, meteorological, and magnetic observations were taken every day until the station was abandoned. A number of the dogs taken to the station died during the first season, but by taking good care of those that were left, and of the new litters that from time to time appeared, Lieut. Greely was able to keep up effective teams for exploration. A number of expeditions were made across the channel to the Greenland Coast. The lowest natural temperature ever recorded was noted by Sergeant Brainard during one of these expeditions—minus 61°. Two of the men, Rice and Jans, returned to the station to get some additional supplies for one of the exploring parties, travelling a distance of fifty miles, without sleeping bags or tents, the temperature being minus 40°. They got what was needed and went back to their party, making the trip in five days. If Arctic exploration does nothing else, it shows that the human body can endure a great deal of cold.

When Lieut. Lockwood made his journey to the highest northern point ever

trodden by man (83° 24.5′) he was accompanied by only two men—Brainard and Christiansen. He carried thirty-five days' provisions on a sled drawn by dogs. At this remote point traces of rnimal life were abundant, tracks of hares, lemmings, ptarmigan, and snow-bunting; a little further south were seen the tracks of bears and signs of the musk ox. This expedition lasted fifty-nine days, and no one engaged in it suffered any serious consequences from the prolonged exposure.

NEW ZEALAND.

W. DAWSON, SPICELAND, IND.

Having been much interested in Professor Pritchett's article on "The Transit of Venus in New Zealand," in the February number of the REVIEW, I have thought some account of the geography, etc., of that colony might, perhaps, be of interest as a kind of supplement to the professor's article.

New Zealand is an English colony of two large islands and a much smaller one, with a number of islets, in the south Pacific Ocean; and pretty nearly on the opposite side of the earth. They are about 1,200 miles southeast of Australia, and 7,000 miles nearly southwest of San Francisco. Although far away, it is a fine and interesting country.

Imagine a long and narrow island lying in a direction nearly northeast and southwest, divided near the middle by Cook's Strait. North island, often called New Ulster, is very irregular in shape; the northwestern part extending far into the ocean, narrows to a point. The northeastern part extends out about one-fourth as far, and rounds off much more obtusely. So the shape of this island is somewhat like a shoe. South island—New Munster—is pretty nearly a parallelogram in shape, and the two taken together resemble a boot in outline as well as Italy does.

Their extreme length is nearly a thousand miles, and the average width about 100 miles. New Ulster is about the size of New York, containing about 48,000 square miles. South island is somewhat larger. The third, called Stewart's Island, is south of New Munster, and Foveaux Strait, fifteen miles wide, is between them. This island is triangular in shape, and contains nearly 1,000 square miles. Cook's Strait is in latitude 40° S.; and longitude 185° W. of Greenwich. It took its name from James Cook, the renowned navigator, who surveyed New Zealand about 1770.

These islands are considerably mountainous; several peaks having an elevation of about two miles. Mt. Cook, in South island, is 13,000 feet high. Many extinct and a few active volcanoes exist. Earthquakes occur sometimes. The coasts are indented with numerous bays, many of which afford excellent harbors. "The climate of New Zealand is one of the finest in the world." The atmosphere is damp, though pure and healthy; disease and sickness being compara-

tively rare. In South island the mean annual temperature is about 52°; in New Ulster 58°. Beautiful plains of country are always clothed in green foliage, and afford rich pasture for great herds of cattle, and vast numbers of sheep, which are thus grown with very little expense. The soil is very productive and easily worked, making agriculture a light and easy employment. A large plant, having leaves two inches broad and six feet long, called New Zealand flax, is a production of great value for home use and export. The leaves contain a very strong fibre used for making rope, twine, linen, etc.

The coast and rivers of New Zealand abound in vast quantities of fish. Captain Cook, in one of his visits there, thought to show the people how to catch fish by exhibiting a seine; but they smiled and pulled down a stack of netting from which they spread a seine four times as large as his. Coal exists there in great abundance. Gold was discovered in New Munster in 1861. The deposit was found to be very rich, and in a few years the product amounted to many millions of dollars. This country was discovered in 1642 by Abel Tasman. For many years after, it was known only as a stopping place for whalers. The natives were cannibals, but were very susceptible to the influences of civilization and religion. A few English had settled there; and in 1814 a missionary station was established on the Bay of Islands, near the north end of New Ulster. About ninety miles south of this the city of Auckland is located; which is still in the northern part of North island. It will be remembered that Auckland is the "well governed city" where Professor Pritchett made his observations. The missionary station on the Bay of Islands was very successful, and Christianity spread over the island to a large extent. But in twenty or thirty years, more emigrants came who were greedy for the fine country. They oppressed the people—provoking them to retaliation, and causing much cruelty; so that Christianity was greatly impaired.

In 1840, the sovereignty of New Zealand was ceded to the British Government. But in a few years new and bloody conflicts arose, because foreigners took possession of lands which the natives believed they had no right to. Finally, some years later all became reconciled, and everybody went to work in good earnest—tilling the soil and advancing the cause of humanity in general. In 1851 the population of New Zealand was estimated at about 146,000—26,000 being foreigners. But since then the natives have decreased about two-thirds, and foreigners increased to about 500,000. As in other countries so in that one—the opening of gold mines was a great incentive to rapid immigration and various improvements. New Zealand has one university of learning, several colleges, and a general free school system of education.

The lamented Captain Cook has given much interesting information about New Zealand, as well as many other islands in the Pacific Ocean.

A NEW VOLCANO.

The Secretary of the Treasury has received from Captain M. A. Healy, of the United States revenue cutter Corwin, under date of Ounalaska, May 28th, two interesting reports by officers of the Corwin describing a visit to the recently upheaved volcano in Behring Sea at the northern end of Bogosloff Island, in latitude 53° 55′ 18″ N.; longitude 168° 00′ 21″ W.

This volcano, which is in a state of constant and intense activity, was upheaved from the sea in the summer of 1882, but was not seen by any civilized eye until September 27, 1883, when it was discovered by Captain Anderson, of the schooner Matthew Turner. A few days later it was also seen by Captain Hague, of the steamer Dora, but no landing upon it was made previous to that by the officers of the Corwin last spring.

Dr. Yemans describes it as a dull gray, irregular, cone-shaped hill, about 500 feet in height, from the sides and summit of which great volumes of vapor were arising. At a height of about two-thirds the distance from the base to the apex of the cone, there issued a very regular series of large steam jets, which extended in a horizontal direction completely across the northwestern face of the hill. Around these steam jets were seen upon nearer approach deposits of sulphur of various hues, which at a distance had looked like patches of vegetation. A landing was effected without difficulty upon a narrow sand spit connecting the new volcano with the old island of Bogosloff, and Dr. Yemans and Lieut. Cantwell undertook the ascent of the smoking cone. It was covered by a layer of ashes formed into a crust by the action of rain, which was not strong enough to sustain a man's weight, and at every step the climbers' feet crushed through it, and they sank knee-deep into a soft, almost impalpable dust which arose in clouds and nearly suffocated them.

As the summit was neared the heat of the ashes became almost unbearable. A thermometer buried in them half way up the ascent marked 196°, and in a crevice of the ramparts of the crater "the mercury rapidly expanded and filled the tube, when the bulb burst, and shortly afterward the solder used in attaching the suspension ring to the instrument was fused." The temperature was estimated at 500° F. On all sides of the cone were perforations through which the steam escaped with more or less energy, and in some cases at regular intervals like the exhaust of a steam engine. The interior of the crater could not be seen on account of the clouds of smoke and vapor which filled it.

"A curious fact to be noted," Lieut Cantwell says, "in regard to this volcano is the entire absence, apparently, of lava and cinder, Nowhere could I find the slightest evidence of either of these characteristics of other volcanos hitherto examined in the Aleutian Islands." Volcanic dust or ash, however, is thrown out in considerable quantities and carried by the wind to places as distant as Ounalaska. After carefully measuring the volcano and photographing it from various points of view the exploring party returned without accident to the ship. Captain Healy reports his intention to visit the new volcano again on his return from St. Michaels and the Arctic.

MEDICINE AND HYGIENE.

THE RELATIONS OF THE SOIL TO HEALTH.[1]

GEORGE H. ROHE, M. D.

I. THE SOIL.—That wisest and most learned of the ancients, Hippocrates, called the Father of Medicine, treated at length in one of his works of the sanitary influence of the soil. Other of the older writers, especially Herodotus and Galen, called attention to the same subject, and Vitruvius, the celebrated Roman architect, who flourished about the beginning of the Christian era, taught that a point of first importance in building a dwelling was to select a site upon a healthy soil.

From this time until the beginning of the eighteenth century, very little of value is found in medical literature bearing upon this subject. In 1717, however, Lancisi published his great work on the causes of malarial fevers, in which he laid the foundation for the modern theory of malaria and pointed out the relations existing between marshes and low-lying lands and those diseases, by common consent, called malarial. Other authors of the eighteenth and the early part of the nineteenth century refer to the connection between the soil and disease, but exact investigations have only been made within the last thirty years. The general want of definite knowledge upon this subject, even among well-educated people, is the occasion of the following pages.

When we consider that the air we breathe, and much of the water we drink, are influenced in their composition by the matters in the soil, the great importance of possessing a thorough knowledge of the physical and chemical conditions of the soil becomes evident to every one.

In the hygienic, as in the geological sense, we include rock, sand, and gravel in the consideration of soils.

The soil, as it is presented to us at the surface of the earth, is the result of long ages of disintegration of the primitive rocks by the action of the elements, of the decomposition of organic remains, and possibly of accretions of cosmical dust. The principal factor, however, is the action of water upon rock, in leveling the projections of the earth's surface, produced by volcanic action.

Soils vary considerably in physical and chemical constitution. We may have, for example, a soil consisting exclusively of sand, of clay, or of disintegrated calcareous matter. Other soils may consist of a mixture of two or more of these, together with vegetable matter undergoing slow oxidation. In forests, we find a layer of this slowly decomposing vegetable matter of varying thickness covering the earthy substratum. This organic layer is called *humus*, and when

1. From the Third Annual Report of the State Board of Health of West Virginia.

turned under by plow or spade, and mixed with the sand or clay-base, it constitutes the ordinary agricultural soil.

II. THE ATMOSPHERE OF THE SOIL, OR GROUND AIR.—The interstices of the soil are occupied by air or water, or by both together. The soil's atmosphere is continuous with and resembles in physical and chemical properties that which envelops the earth. Its proportion to the mass of the soil depends upon the degree of porosity of the soil and upon the amount of moisture present. In a very porous soil, such as for example a coarse sand, gravelly loam, or coarse-grained sandstone, the amount of air is much greater than in a clayey soil, granite, or marble. So, likewise, when the soil contains a large proportion of water, the air is to this extent excluded. The porosity of various soils, as evidenced by the amount of air contained in them, is much greater than would at first thought, be supposed. Thus it has been found that porous sandstone may contain as much as one-third of its bulk of air, while the proportion of air contained in sand, or loose soil may amount to from thirty to fifty per cent.

The ground-air is simply the atmospheric air which had penetrated into the interstices of the soil and taken part in the various chemical decompositions going on there. In consequence of these chemical changes, the relative proportions of the oxygen and carbonic acid in the air are changed, oxygen disappearing and giving place to carbonic acid. It is well known that, during the decay of vegetable matter in the air, carbonic acid is formed; one constituent of this compound —the carbon—being derived from the vegetable matter, while the oxygen is taken from the air. Hence, if this action takes place where there is not a very free circulation of air, as in the soil, the air there present soon loses its normal proportion of oxygen, which enters into combination with the carbon of the vegetable matter to form carbonic acid.

Thirty years ago, MM. Boussingault and Levy, two distinguished French chemists, examined the air contained in ordinary agricultural soil, and found that the oxygen was diminished to about one-half of the proportion nominally present in atmospheric air, while the carbonic acid was enormously increased. The exact results obtained by Boussingault and Levy were as follows:

In one hundred volumes of ground air there were 10·35 volumes of oxygen, 79·91 volumes of nitrogen, 9·74 volumes of carbonic acid. In atmospheric air, on the other hand, there are in one hundred volumes 20·9 volumes of oxygen, 79·1 volumes of nitrogen, 0·04 volumes of carbonic acid, or about one twenty-fifth of one per cent of carbonic acid.

In spite of the striking results obtained by these two chemists, very little attention was paid to them by sanitarians, as very few seemed to have any clear notion of the relations existing between the motions of the air above ground and that under ground.

In 1871, however, Prof. Von Pettenkofer, of Munich, whose authority in sanitary matters is second to none, published the results of his own examinations into the constitution and physical conditions of the ground air, and the relations of the latter to the propagation of epidemic diseases. These researches, which

created a widespread interest in the subject, were extended by other observers in all parts of the world. These observers, prominent among whom were Professors Fleck and Fodor in Germany, Drs. Lewis and Cunningham in India, Prof. Wm. Ripley Nichols in Boston, and Surgeons J. H. Kidder and S. H. Griffith, of the U. S. Navy, in Washington, demonstrated that the increase of carbonic acid in the ground air is due to increased vegetable decomposition and to lessened permeability of the soil. A permeable, that is to say, a sandy or gravelly soil, is likely to contain less carbonic acid in its atmosphere than a dense, less permeable clay, although the amount of decomposition going on, and the production of carbonic acid in the former, may considerably exceed the latter. In the loose sandy soil the circulation of the air is less obstructed, and the carbonic acid may easily escape and be diffused in the superincumbent air, while the close-pored clay imprisons the carbonic acid and prevents or retards its escape into the air above.

The disappearance of oxygen from the ground atmosphere is coincident with the production of an equivalent amount of carbonic acid. It appears from this that in the soil an oxidation of carbonaceous substance takes place, the product of which is the excess of carbonic acid in the ground air.

Prof. Nichols has found the proportion of carbonic acid in the air taken from a depth of ten feet below the surface in the "made land" of Boston, amount to 21·21 per thousand, the observation being made in August. In December, at a depth of six feet, the proportion was 3·23 per thousand. Fodor, in Buda-Pesth, found the proportion of carbonic acid to be 107·5 per thousand (over 10 per cent), the air being taken from a depth of thirteen feet.

Movements of the ground atmosphere are principally due to differences of pressure and temperature in the air above ground. Owing to such differences the air from the soil frequently permeates houses, entering from cellars or basements. In winter, when the air of houses is very much more heated (and consequently less dense) than the air out of doors, the difference of pressure, thus caused, draws the ground air up through the house, while the cold external atmosphere penetrates the soil and occupies the place of the displaced ground air.[2] A similar effect occurs in consequence of heavy rains. The water fills up interstices of the soil near the surface, and forces the ground air out at points where the pores remain open. These places are the dry ground under buildings, where the air escapes and passes through floor and ceilings into the house above. Heavy rains may thus be the cause of pollution of the air in houses. The greater the porosity of the soil, the more likely is this to happen. This pollution of the house air may be prevented by having impervious floors and walls to cellars and basements, or by interposing a layer or charcoal between the ground and the floor of the house.

In the spring and early summer the ground being colder than the air above

2 It is, of course, not strictly correct to say that the air *is drawn up* through the house by the diminution of pressure; it being rather *forced* out of the soil by the colder and denser outside air; but the phrase is sufficiently exact and will be readily understood.

it, and the ground air consequently heavier and denser, the latter is not easily displaced. It is perhaps due to this fact that those infectious diseases which are probably dependent upon the movements of the ground air, are less prevalent in the spring and early summer than in the latter part of summer, autumn, and early winter. In the autumn, the ground air being warmer than the air above ground is easily displaced by the latter, and forced out into the streets and houses to be inspired by men and animals. The same conditions may explain the greater likelihood of infection at night, which is proved for such diseases as malarial and yellow fevers. The colder outside air penetrates the interstices of the soil, and forces out the impure ground air.

The researches of Fodor have demonstrated that the proportion of carbonic acid in the ground air may be taken as an approximative measure of the impurity of the soil whence the air is taken. The influence of the permeability of the soil, as before pointed out, must however not be overlooked in estimating the signification of the carbonic acid. Fodor has shown that the proportion of carbonic acid in the ground air, and consequently the amount of organic decomposition, is greatest in July and least in March. That the carbonic acid is derived from the decomposition of organic matter has been proved by Pettenkofer. This observer examined specimens of air brought from the Libyan desert, and found that the proportion of carbonic acid in the ground air was exactly the same as in the air collected above ground. There being no vegetable growth in the desert there can, of course, be no vegetable decomposition going on in the soil.

The excess of carbonic acid in the ground air is an indication of the deficiency of oxygen, as has been shown. The air at a depth of thirteen feet below the surface was found to contain only from 7 to 10 per cent of oxygen—one-half to one-third of the normal proportion. Many basements occupied by people as living rooms extend from five to ten feet under ground, and hence are liable to be supplied with an atmosphere approaching in impurity that just mentioned. It requires no very vivid imagination to appreciate the dangers to health that dwell in such habitations.

III. The Water of the Soil, or Ground Water.—At a variable depth below the surface of the ground, a stratum of earth, or rock, is found, through which water passes with difficulty, if at all. Above this, there is a stratum of water which moves from a higher to a lower level, and which varies in depth at different times according to the amount of precipitation (rain or snow-fall) and according to the level of the nearest body of water toward which it flows. This stratum of water is termed the *ground water*, and has within the last few years assumed considerable importance from its apparently close relations to the spread of certain of the infectious diseases. The direction of horizontal flow of the ground water is always toward the drainage area of the district. Thus, it is usually toward lakes, rivers, or the sea. Rains or a rise in the river cause a rise in the ground water, while long continued dry weather, or a low stage of the river, which drains off the ground water, causes a fall in the latter. On the sea-coast the ground water oscillations probably correspond with the tides. The writer is not

aware of any observations made to determine this point. In Munich, where the ground water flows toward the river Isar, which divides the city, it has been found that the annual range or oscillation (the difference between the highest and lowest level during the year) is ten feet, while the horizontal movement amounts to fifteen feet per day. In Buda Pesth the annual range was found by Fodor to be less than three feet, while in some portions of India it amounts to more than forty feet. As it is from the ground water that the greater portion of the supply of drinking water in the country and in villages and small towns is drawn, it becomes at once manifest how important it is to prevent, as far as possible, pollution of this source. Cesspools and manure heaps and pits, of necessity, contaminate the soil, and also ground water, for a distance below and around them, and such water is clearly unfit for drinking and other domestic purposes. Hence, the reason why wells should not be placed too near privies and manure heaps or pits becomes apparent.

Between the level of the ground, or that portion of the soil where its pores are entirely occupied by the water—where, in other words, the ground is *saturated* —and the surface is a stratum of earth more or less *moist;* that is to say, the interstices of the soil are partly filled with water and partly with air. It is in this stratum that the processes of organic decay or putrefaction are going on, in consequence of which the pollution of the ground air occurs. Recent observations seem to show that these processes of decomposition are initiated and kept up by minute organisms, termed *bacteria*, just as fermentation in liquids containing sugar can only take place in the presence of the yeast plant. It has been found that when non-putrefactive decomposition goes on, there are always present multitudes of one variety of these minute organisms; while if putrefactive decomposition is going on, a different variety of these organisms is present. Just as, when a fermenting liquid becomes putrid, the yeast plant disappears and its place is taken by the ordinary bacteria of putrefaction, so in the soil, if the access of oxygen which is necessary to the life of the bacteria of decay is prevented, these organisms die and are succeeded by the organisms of putrefaction. It has been found that in a soil saturated with water the bacteria of decay cannot live, while those of putrefaction may flourish, because these latter organisms can sustain life in the absence of oxygen. Prof. Fodor's researches indicate that the organism of non-putrefactive decomposition or decay is that which is termed by Cohn *bacterium lineola ;* and that the *bacterium termo* is the principal organism of putrefaction.

IV. The Diseases Spread by Soil Impurities.—Given now an area of soil, say the ground upon which a house or city is built, with a moist stratum in which the processes of decay are active, and imagine a rise in the ground water. The ground air, charged with carbonic acid and other products of decomposition, is forced out of the pores of the soil by the rising ground water, and escapes into the external air, or through cellars and basements into houses, and may there produce disease. But the saturation of the soil with water prevents the further development of the bacteria of decay, and putrefaction takes place. If, now, the ground water sinks to its former level or below, the processes of the decay again

become very active in the moist stratum, and large quantities of carbonic acid and other inorganic compounds are produced. If the germs of infectious or contagious diseases have been introduced into the soil, they also multiply, and may escape with the movements of the ground air into the external atmosphere, and there produce their infective action.

This, it is held by Pettenkofer and his followers, is what actually occurs in cholera and typhoid fever. Prof. De Chaumont has laid down the rule that a soil with a persistently low stage of ground water, say fifteen feet below the surface of the ground, is healthy; a persistently high stage of ground water, less than five feet below the surface, is unhealthy, while a fluctuating level of the ground water, especially if the changes are sudden and violent, is very unhealthy. This would lead us to expect that places where this fluctuation is very great would show a large mortality from such diseases as are attributed to impurities in the soil. And this we find especially true in India. In certain localities in India, cholera, for example, is endemic—that is to say, the disease is never entirely absent in such localities. Calcutta is one of these places. The rainy season begins about the first of May and continues until the end of October. During the next six months there is very little rain. It is fair to assume that the ground water rises during the rainy season, and checks decay and the multiplication of the germs of the disease in the soil, and that these processes become more active as the dry season advances and the ground water level falls. If we note the death-rate from cholera in Calcutta, it will be found that it bears a distinct relation to the movement of the ground water. The deaths from cholera begin to increase from October, and reach their height in April. Dr. Macpherson, who has written a very elaborate history of Asiatic cholera, shows this relation very clearly. For twenty-six years the average annual rainfall was sixty-three inches. From May to October fifty-seven inches fell, while the remaining six inches fell from November to April. The average number of deaths from cholera annually was 4,013. Of these, 1,238 died in the rainy season, while 2,775—nearly three-fourths—died during the period of dry weather.

In the cholera epidemics of 1866 and 1873 in Buda-Pesth, the same relations existed between the ground water and the cholera. As the level of the ground water rose, the cholera diminished, while the disease increased upon the sinking of the ground water. Exactly the same behavior was exhibited by the disease in Munich in 1873.

There seems good reason to believe that typhoid fever is propagated in consequence of movements of the ground water, in the same way as above explained for cholera. This does not exclude the infection of drinking water by the disease germ, since much of the drinking water used, as before stated, is drawn from the ground water. Pettenkofer, Buhl, and Virchow have shown that the death-rate from typhoid fever has a distinct and definite relation to the ground water oscillations. This has been incontestably proved for two cities, Munich and Berlin. When the level of the ground water is above the average, typhoid fever decreases; when it is below the average, the number of cases becomes greater.

Facts at present on record indicate that the stage of the ground water has an unquestionable relation to the sickness rate from intermittent fever. Malarial fevers are generally believed to be the invariable accompaniments of life in marshy regions, and so they usually are. But it is a noteworthy fact malarial diseases are neither most frequent nor most virulent when the swamps are full. It is in the latter part of summer and early autumn, when the water is being gradually evaporated, and the swampy soil is drying out here and there—when the decomposition becomes active—that the fevers begin. In the winter and spring, when the ground becomes saturated to the surface from the abundant precipitation, and the processes of decomposition are checked, the fever disappears or, at all events, the cases decrease in number and severity.

About twenty years ago Dr. Henry I. Bowditch, of Boston, called attention to the frequent connection between cases of pulmonary consumption and dampness of the soil upon which the patients lived. After a very extended and laborious investigation, Dr. Bowditch formulated these two propositions:

"First—A residence in or near a damp soil, whether that dampness be inherent in the soil itself or caused by percolation from adjacent ponds, rivers, meadows, or springy soils, is one of the principal causes of consumption in Massachusetts, probably in New England, and possibly other portions of the globe.

"Second—Consumption can be checked in its career, and possibly—nay, probably—prevented in some instances by attention to this law."

Dr. Buchanan, of England, about the same time showed that the thorough drainage of certain English cities had markedly diminished the deaths from consumption in the drained cities. So far as the writer is aware, not a single fact has been established which militates against the law laid down by Dr. Bowditch and as strongly supported by the statistical researches of Dr. Buchanan, yet hardly any notice has been taken of these results by physicians. Few know anything of them, and still fewer seem to have made practical use of such knowledge in advising patients. As corroborative of the views of Dr. Bowditch, the rarity of consumption in high and dry mountainous districts or plateaus may be cited.

V. Diseases of Animals Probably Due to Similar Conditions of the Soil.—The modern study of the sanitary relations of the soil is still in its infancy. Whatever definite knowledge has been gained relates merely to physical or chemical conditions of the soil and its atmosphere and moisture, or possibly the relations of these to the spread of certain diseases in human beings. But there is, perhaps, a wider application that may be made of such knowledge than has been heretofore suggested. The domestic animals which form such a large proportion of the wealth of this country—horses, cattle, sheep, and hogs—are liable to infectious and contagious diseases as well as human beings, and many millions of dollars are lost annually by the ravages of such diseases. Now, from what is known of such diseases as *splenic fever* among cattle, and of the so-called *swine plague*, it does not appear improbable to the writer that the source of infection is a soil polluted by the poisonous germ of the diseases, just as it seems demonstrated that chol-

era and typhoid fever, and possibly malarial fevers, are so caused. The laborious investigations of M. Pasteur, in France, have shown that the cause of splenic fever when once introduced into a locality will remain active for months and even years, and it does not seem out of place to suggest to the readers of this report, most of whom are interested in the preservation of the health of the domestic animals, and that a study of the soil in its relations to the diseases of these animals is a subject to which they may direct their attention with profit.

It is well known that milch cows frequently suffer from a disease identical in its nature with the consumption in human beings. It is believed by many that the milk of such animals is not only unfit for food by reason of its poor quality, but that it may convey the disease to human beings when used as a food. The observations of Bowditch and Buchanan, quoted above, show that consumption in man may be, and doubtless is, frequently caused by soil wetness. It seems probable that the same cause should produce similar effects in the lower animals, and it is the writer's firm conviction that an examination into the circumstances under which cows get consumption would prove this probability a fact.

VI THE PREVENTIVE REMEDY—DRAINAGE.—To secure a constant level of the ground water at a sufficient depth below the surface, drainage is necessary in many soils. Agriculturists know the value of proper and efficient drainage in improving the productive capacity of wet soils, but the men who build houses for human beings to live in, or stables to shelter animals, never give this matter much thought. Few of our architects have ever heard of the injunction of the ancient master of their craft, quoted in the beginning of this paper, to select a healthy soil upon which to build a dwelling, while a stable is frequently built partly underground, and in localities where all the conditions promoting disease are present. If farmers can once be made to understand that a wet stable, whether for horses, cows, sheep, or hogs, is an unhealthy stable, reform would soon be introduced. If they could be further convinced that a marshy or springy soil is not a healthy pasture ground, such places would soon be drained. If it were found, then, that by taking these precautions the health of animals was improved and their lives preserved, perhaps architects and builders in town and country would also learn that a dwelling cannot be healthy and comfortable unless built upon a clean, dry soil.—*Scientific American Supplement.*

Science for July 25th, announces that Dr. Chavanne, who is travelling on the Congo for the Brussels National Institute of Geography, has established a meteorological observatory at Boma. Mr. Stanley has transferred the site of his station of Vivi to a table-land some 1500 metres to the north; and a railway station from it to the Congo is being constructed. Another station, called Sette-Cana, has also been established at the mouth of the small river Sette.

ASTRONOMY.

VELOCITY.—II.

EDGAR L. LARKIN.

In this REVIEW for April we stated that a mass falling an infinite distance on a straight line, not meeting resistance, will strike the Sun with a velocity of 382.95 miles per second. It is almost impossible for a body to make a straight-line flight. The only instance is when a mass approaches on that tangent to the solar orbit on which the Sun is moving at moment of collision. The Sun traverses a path which analogy teaches to be a curve, hence moves in direction tangent to orbit. Construct a straight line from A to B, bisect it, place the Sun's centre at bisection, let it move towards B, and the line will be tangent. Let point of tangency always coincide with the center of the Sun—then will the points A and B and the tangent shift. Curvature is slight, arcs scarcely differ from straight lines for immense distances, thence—as the Sun moves, the tangent changes direction.

Assume space interspersed with comets, bolides and other masses having velocities in all directions determined by differences of attraction of suns. Midway—motion is slow—but none rest. Solar gravity in turn disturbs all bodies distributed in a tubular space whose diameter is twenty trillion miles, and length equal to that of the Sun's orbit; that is: dominates space whose radius is ten trillion miles on assumption that nearest stars have parallaxes of 1″, and masses each equal to the Sun's.

If the Sun and a stone be moving towards the same point from opposite directions in the same plane, and if at some epoch in the history of the stone's flight, its path becomes tangent to the orbit of the Sun at an instant when the Sun is in such position that the tangent A B coincides with the path of the stone, then collision will ensue, the stone reaching the Sun on a straight line—the only case possible.

Such combinations are rare, hence cosmical masses seldom make direct impact on the Sun, few reaching it with highest speed; that generated by fall from infinite distance. To find maximum velocity of impact we made G = square root of product of twice the Sun's gravity on surface multiplied by its radius, finding G to equal 2,022,008 feet per second. This velocity is that derived from fall from *infinite* distance. From *finite*, —V=G× by square root of quotient found by dividing twice the distance less 1, by twice the distance. These formulas we find in standard astronomical works, and by using them in computation to extended decimals, it was learned that if a body begin to fall from 1,000,000 or 20,000,000r, the difference of velocities of impact will be 1 foot per second, thus:

Fall from Infinite Space=2,022,008 feet per second.
" " 20,000,000r =2,022,008 " " "
" " 1,000,000r =2,022,007 " " "

But 20,000,000r is nearly half the distance, to the nearest sun, while 1,000,000r is only 157 times the distance of Neptune. It follows that if a comet makes near approach to the solar surface on parabola or hyperbola, it cannot be determined whether it began to fall from distance equal to 1 or 2,000, for a body traversing a right line from 10,000r to the Sun will collide with velocity of 2,021,957 feet, and from 20,000,000r—2,022,008 feet per second, the difference being 51 feet, ratios of distances fallen being as 1 to 2,000. The comet of 1843 passed perihelion at a distance of—"One-fifth the Sun's semi-diameter," Newcomb and Holden's "Astronomy," p. 406. Calculating, using formula,—V=G ×by square root of quotient of distance divided by square of distance, we found velocity of comet at perihelion to have been 349.6 miles per second. But, it traversed a parabola and vanished from the solar system; doing so because its velocity was too great to permit it to yield to solar attraction and fall on the Sun; and because it was not moving on the line A B at epoch. Velocity and direction decided whether it disappear on parabola or fall on ellipse and make future circuits.

Its velocity—too rapid by forty-one per cent, evolved centrifugal tendency surpassing gravity, and bore it away on a parabolic curve. Making orbital velocity (V) when centrifugal tendency and gravity balance, we find V=G×by square root of quotient of distance from Sun's centre divided by twice the square of distance=247.2 miles per second. (Distance=1.2). Had the comet this velocity at instant of perihelion, it would have fallen into an ellipse whose major-axis would have direction determined by angle made with radius vector by the comet's path. With such velocity, and direction at a right angle,—then would comet have made future revolutions on a circle. The result 247.2 may be obtained with less computation, for 349.6÷1.4142=247.2; but this 1.4142 is the square root of 2; hence orbital velocity at a distance from the Sun's centre where centrifugal tendency equals gravity, is to fall from an infinite radius to that distance as 1 is to the square root of 2. Or,—velocity on a closed, as circle or ellipse, is to velocity on an open conic as parabola or hyperbola as 1 : 1.4142, an excess of .4142 velocity over circular or elliptical orbital velocity, being required to thrust a body beyond the solar system to a distance equal to that whence it begun to fall.

Place a cannon at right angles to a radius of the earth, fire a ball with a velocity of 4.90833 miles per second, and in absence of air, it will not fall, but revolve like a satellite. Elevate the ball to a distance equal to the earth's mean radius—3958 miles—and let fall; it will strike with velocity of 4.90833 miles per second.

The earth's distance from the Sun is 92,882,000 miles, and velocity 18.49+7 miles per second.

Take a stone 92,882,000 miles from the earth, i. e. 185,764,000 from the Sun, and let fall. It will approach the Sun, but while passing the orbit of the earth, its velocity will be same as the earth's orbital motion. Therefore, spaces once fallen through by planets to acquire their velocities were equal to their present distances from the Sun.

The tangent A B slides round the solar orbit, the Sun forever moving towards B, hence most bodies approaching from that direction traverse paths making some angle with A B and cannot, therefore, make impact on the Sun. Their directions and velocities will cause them to miss the target and escape solar flames. Celestial bombardment is unskillful, cosmic missiles rarely hit the mark.

Towards B, may be termed front; A, rear,—then masses from front, not colliding with the Sun, will pass perihelion to the rear, and *vice versa;* while from other points, perihelia will fall at all distances and directions from the Sun's centre. Some astronomers hold that now, B is in right ascension 17h., and north declination 35°—the direction of solar motion. Bodies find it difficult to strike the Sun; few strike it at all, and less—with maximum velocity.

In this publication for May, 1882, we took this position and claimed that maximum heat of conservation of velocity seldom obtains.

Bombardment does not supply much of the Sun's heat. Most masses run down spirals making circuit often in retarding gases before colliding. Velocity must fall below 270.79 miles per second, which motion is then in direction tangent to the solar surface before cosmical masses richochet, This question of velocity is one of importance in astronomical researches, and worthy the attention of all.

NEW WINDSOR, ILL., July 17, 1884.

PROCEEDINGS OF SOCIETIES.

SCIENTIFIC PROGRESS.[1]

A. R. FULTON.

Like most institutions of a similar character, ours may seem to be of slow growth, but I have confidence in its ultimate success. Associations of this kind are not likely to attract the masses, for the reason that their objects are purely intellectual, and do not appeal to the emotional or sensational nature of men. Yet, by a careful investigation of the problems which nature presents for thought and study, we find enough that is marvelous, enough that excites wonder and admiration, to lead us very soon to feel the force of the declaration that "Truth is stranger than fiction." There are indications of a steadily increasing interest

1. An address read before the Iowa State Academy of Science, July 8, 1884.

in scientific investigation among people who are not professors in colleges, brought about mainly through the influence of such organizations as ours, and by the dissemination of popular scientific literature. There are departments of scientific research, such as those of geology, botany, and entomology, that do not require expensive apparatus, and all of these are full of interest and attraction for both old and young, especially after a limited understanding of their principles is once obtained.

For instance, in the comparatively new science of geology, you will find many people who are conversant with its leading facts and principles, as they have been demonstrated after the most laborious research. Even the school-boy of to-day has his limited collection of fossils and minerals. He is able to classify them and explain as to what geological age his fossils and minerals represent. He learns from them how the world was made, and, by analogy, how other worlds are made. His mind expands to a conception of the forces of nature constantly in operation to bring about the wonderful changes which mark the different cosmical stages in the geologic calendar. The grand mystery of creation is unfolded before him as he descends in the scale from the age of man down through the ages of mammals, reptiles, amphibians, fishes, invertebrates and zooliths, to that of primordial vegetation, and thence to the azoic age, when no life, animal or vegetable, could exist, and when the earth was indeed "without form and void," as declared in that first great scientific essay, the authorship of which is attributed to Moses. I refer especially to the science of geology, because, as now developed, it comprehends some knowledge of what have in the past been treated as separate and distinct sciences, such as natural philosophy, astronomy, chemistry, botany and others.

No man can pursue geological investigation without learning something in all these departments of science. He must be something of a natural philosopher to ascertain and comprehend the causes, or forces, in nature which have resulted in the formation of the varied strata of which the crust of the earth is made, for he knows that every effect is the result of some adequate cause. He must know, or learn, something of the laws which govern the movements of cosmical bodies, among which our earth is but comparatively an atom in the universe. He will necessarily learn of the elements, and the chemical combinations which exist in the rocks and the minerals, of which the earth is composed. In the study of the fossils, animal and vegetable, which he finds in the solid rocks, imprisoned in what was but plastic matter so many long ages ago, perhaps millions of years, he will compare the conditions and forms of ancient organic life with those now existing, and which in turn, will leave traces of their history to be investigated by the geologist of some far future age. He must, therefore, become more or less familiar with the sciences known by the distinctive names of zoölogy, entomology and botany. Geology is, indeed, a science which may be termed composite, for it comprehends the elements of various other sciences. If you desire a student to enrich his mind with an extensive range of scientific knowledge, you cannot do better than to interest him in geology. Its fundamental principles

are as positively demonstrated as any problem in mathematics may be, while there is enough that is still theoretical and speculative to incite investigation, and this is not an unprofitable employment for the mind, for it is the source of all our acquired knowledge. The pursuit of scientific study brings the mind into nearer relation to the Supreme Power that has brought worlds into existence and guides all their motions, through the operation of immutable laws.

Our finite conceptions have never been able to comprehend but few of the mysteries of creation. We behold—we wonder—and man in all stages and conditions of his existence, has ever been striving to solve the great problems of nature. In the earlier and ruder ages of his history this longing to solve the mysteries of the physical and metaphysical led to the development of various systems of mythology, as those of the Egyptians, Grecians and Romans. Even the unenlightened tribes of this day have their myths and mystic ceremonies. The present generation of Pueblo Indians retain and practice the formulas of that nature-worship which has come down to them from their ancestors, who in the unknown centuries of the past, probably erected the temples and cities whose massive ruins have excited the wonder of archæologists. These are but expressions of that universal longing to know more of the mysteries of physical being. That principle, which is universal and eternal in the human mind, to know the relations and the causes of things, dwells with the savage as with the sage. The ancient Hellenic mind invested the mountains, valleys, plains, and seas of Greece with deities, all under the supreme rule of Zeus, the victor in the Titanic war, who established the seat of his power on Mount Olympus, and controlled the lesser deities, which Grecian polytheism or imagination had conceived as having subordinate control over the various elements of physical nature, as well as human passions, thought, and action. Every deity in their mythology but personified some phase of mind or matter, which the science of that magnificent people could not explain. In obedience to that principle of the human mind to which I have referred, a desire for knowledge, they sought to solve the mysteries of the universe, and our higher and more exact knowledge is but a stage in the upward progress of the grand march of human investigation.

The adequacy of the science of to-day to explain many of the phenomena of physical nature has been a most potent factor in releasing the human mind from the thralldom of superstition. The occurrence of an eclipse of the Sun or Moon is not now regarded with dread, or as indicating the anger of the gods. The astronomer, or the mathematician, is competent to foretell, without the gift of prophecy, every obscuration of those bodies, total or partial, for a thousand years to come. To us a November meteoric shower is no evidence of a war raging among celestial beings, nor does the comet that blazes athwart the heavens inspire in us any terror for the wrath of a displeased deity, threatening destruction to nations and rulers. The tornado's wrath may be terrible, but we know it sweeps down upon us in obedience to some elemental law, and is not the dread messenger of any supernatural agency. The rainbow does not come to us with messages from Olympus, nor as a goddess to cut the last thread that binds the

soul to the dying body, as in the really beautiful and exquisite myth of Iris; but it is simply the different colors of the spectrum, brought to view by the refraction and reflection of the Sun's rays in drops of falling rain. While it may be that the highest and noblest aim in the pursuit of scientific study is not mercenary, it is not to be denied that science has added vastly to the world's material wealth.

When Werner in Germany, and Hutton in Scotland, near the close of the eighteenth century, became the founders of opposing theories as to the origin of the strata of the earth, each doubtless pursued his investigation with little thought that he was giving an impulse to that which was soon to develop into a science, from which the world was to derive vast economic benefits. These fathers of the science of geology wrought for the purpose of discovering facts which had hitherto been hidden from men. Their reward came from that pure gratification which results from the pursuit of science for the love of it, while the great mining and agricultural communities of the world are to day receiving the economic benefits of their researches. A large proportion of the scientific discoveries of the present age are utilized in the various departments of human industry. The application of steam, electricity and the laws of chemistry to various economic uses are examples of what science has done and is doing to promote the material welfare of man. In all the operations of nature there has been a continued succession of cause and effect, and the very last effect of any given cause runs back in an unbroken line to the *very first cause.* There is, *in fact,* not a single missing link in the great chain of nature's course, reaching back through the million of ages to the unknown time—"In the beginning." There are links in this unbroken chain which have not yet been revealed to the eye, or to the understanding of man. It is the province of science to discover them—to search out the truths which exist in nature, which have been heretofore unknown to us. All the facts and possibilities which science has revealed respecting electricity may have existed as fully and completely a thousand, or ten thousand years ago, as now, but there had not yet been born to science a Franklin, a Morse, an Edison, or a Phillip Reis. Nature held within her repository all the unwrought materials and elements required for the construction of the steam engine long ages before science discovered the means of applying to practical use this wonderful agent which now acts in obedience to man's will. From spinning the most delicate silken thread to drawing the freighted train, or propelling the mighty steamer, who can estimate the work of this servant of man? In every part of the world where civilization has established itself, this mighty force—this modern hercules of science—is the agent of man's will. The steam engine has revolutionized the industrial world, and added immensely to the material advancement of the race, while electricity is employed to bring the nations of the earth into hourly speaking relations. A great political assembly in Chicago names a citizen for the highest office that the suffrages of the American people can bestow, and before the presiding officer of the convention can restore order, broken by the shouts of rejoicing in the great building by the lake, the lightning has flashed intelligence of the result

to the people of London and Liverpool, and almost as quickly the news is read in different languages in Paris, Berlin, Vienna, Rome, and St. Petersburg.

Another of the triumphs of modern science enables man to hold verbal communication with his fellow man, though separated by hundreds of miles—to recognize the very intonations of the voice of his friend, as if conversing face to face. These are but a few of the grand gifts of modern science to the commercial, intellectual and social world. There are many others, as in chemistry applied to agriculture, medicine and the arts. In the secluded quiet of the laboratory men like Pasteur are daily searching out and bring to light the hitherto hidden secrets of nature, and are contributing their discoveries to the constantly accumulating store of human knowledge and human blessings. We, as an Academy, or as individuals, may add no original discoveries to the sum of scientific knowledge. We may, however, have our thoughts and views enlarged by being interested observers of the truths which science has revealed, and which are constantly coming to light in its onward progress. It may be the good fortune of our humble Association, as it grows in strength and influence, to impart to some youthful mind the inspiration that may develop into important scientific results. All must concede that our purposes are of an elevating character, and our Society such as all thoughtful people must commend, even if they do not take an active interest with us. Every young person who attends a meeting of the Academy comes with a higher and nobler purpose than that which would prompt him to attend an ordinary amusement or pleasure resort. Our Society has been very economically managed. We are not in debt, and have, I believe, a small balance in the treasury. We need funds, however, to make provision for our collections, and for such contributions as are being made from time to time. We should also be able to support an occasional course of public scientific lectures.

Des Moines is rapidly advancing in population and wealth, and although its leading citizens are largely engrossed in money making, many of them are not indifferent to things which tend to intellectual advancement. Who knows how many such might be induced to become life members of this Academy, if for no other reason but to give assistance and encouragement to a commendable institution of the city?

And now, fellow members of the Academy, hoping that all of us will work together for the realization of our highest ideal, and thanking you for your confidence as expressed in calling me for another year to preside over your deliberations, I conclude this paper.

THE HISTORY OF THE TELEPHONE.

Mr. E. Berliner, well known to those of our readers who are versed in telephonic matters, has sent the following communications to the *Electrical World*. This gentleman's remarks concerning Bourseul will doubtless be specially interesting to one of our most distinguished scientists who has so warmly espoused the cause of Reis.

Mr. Berliner says:

The general impression having at all times been that Reis was unacquainted with Bourseul's ideas relating to the electrical transmission of speech, and that he was an original inventor, the following article from the *Didaskalia*, a semi-weekly printed in Frankfort-on-the-Main (the abode of Reis from 1848 to 1854), a paper devoted to belles lettres, arts and sciences, and which in its time had a large circulation throughout Middle and Southern Germany, will be interesting to all electricians.

The article is from the 32nd volume of the *Didaskalia*, in No. 232, and the issue bears the date Thursday, September 28, 1854.

The undersigned has prepared a verbal translation of this remarkable document, and through the kindness of the editor of this paper has commented on it in another column of this issue.

E. BERLINER.

DIDASKALIA. 32nd volume. No. 232. Frankfort, September 28, 1854. *Electrische Telephonie.*

The wonders with which electricity has surprised us lately will, as it seems, be augmented by a new one which will not only produce a revolution in the present electrical telegraphy, but will also enhance its utility in an incalculable manner. It concerns nothing more or less than the electrical transmission and rendition of the *spoken word.* The idea originated with a young and modest but educated man, Charles Bourseul, who in 1848 was a soldier of the African army, where he made himself observed to the Governor-General by a mathematical course which he gave to his comrades of the garrison in Algiers; he now lives in Paris. Perhaps Bourseul's problem, of the feasibility of which he is perfectly convinced, belongs to the line of those discoveries which the learned world afterward declares as very simple, and of which they would then make us believe would have been found out much earlier if they would have taken the trouble (to find it). As we know, the principle on which electro-telegraphy is founded is the following:

An electric current circulating in a metal wire transforms a piece of soft iron with which it comes in contact(?) into a magnet. As soon as the current ceases, the magnetic quality gives way. This magnet, the electro-magnet, can therefore alternately attract and let go a movable plate which, by its motion of coming and going, produces the conventional signs which are used in telegraphy.

It is furthermore known that *all* tones are communicated to the ear merely by undulations of the air, being, therefore, themselves nothing but these undulations of the air, and that the differences (without end) of the tones depend solely and exclusively on the rapidity and the strength of these sound-waves. If, now, a metal plate could be invented so movable and flexible as to render all the tone undulations equal in the air, and if this plate be so connected to an electric current that it would alternately make and break the electric current according to the air undulations by which it is struck, then it would be possible to cause a second similarly constructed plate to electrically repeat at the same time exactly

the same undulations as the first plate, and it would therefore be the same as if a person had spoken in the immediate neighborhood against this second plate, or the ear would be affected in the same manner as if it received the tones communicated through the first metal diaphragm (*mettallwand*=wall, partition, E. B.). The electrical telegraphy which at the time was stamped, academically, almost as nonsense, now traverses the whole world as a familiar phenomenon. If we consult, in regard to this new idea of a young physicist, the principles of physics, we have not only nothing to say against the possibility of its execution, but its success seems more probable than did electrical telegraphy not long ago.

If the experiment succeeded, then electrical telegraphy would have become quite good; it would require no other machinery and knowledge than a galvanic battery, two vibratory plates and a metal wire; without further preparation one person would have only to speak against the one metal plate and the other person to hold his ear to the other, and thus they could converse one with the other as under four eyes (*unter vier augen*=personally).

The young inventor believes in the success of his endeavors, and challenges the learned men to prove that the laws of physics are in contradiction with the above recited principles, and that they let appear impossible what is looked for.

In the meantime this matter would deserve the attention it will receive, in the highest degree.

(Signed), L.

—*London Electrical Review.*

METEOROLOGY.

METEOROLOGICAL DISCOVERIES.

ISAAC P. NOYES.

Discovery is the act of obtaining facts in regard to any subject. The great discoverers of the world are they who have ascertained facts in relation to the conditions of nature. The higher the type of the discoverer the more cause and effect will enter into his composition, and the more his work will reveal it. Not only will he seek to discover facts, but also the relations which these facts bear to each other and the results of their influence upon the forces of nature. No matter how capable a discoverer may be, no matter what his powers of mind and body, he is more or less hampered by his surroundings.

The globe on which we live, even at this late day is not entirely discovered, and although the undiscovered portions are comparatively small, no one at present can tell what influence their discovery will have upon the human race.

Although the world was highly civilized and had, centuries ago, made astro-

nomical discoveries, whereby it knew about the heavens, and geographical discoveries, whereby it knew of the earth, up to within a very late period it knew little, comparatively nothing, about that great stratum immediately above us, which we term the atmosphere. Until we had a Weather-Map, covering considerable extent of territory, it was impossible to obtain such data as would put us in the way of acquiring the necessary information. It may be asked, why we did not have this map at an earlier day? We might ask. why the "Western Hemisphere" was not discovered at an earlier day, why it was that the civilized world did not sooner learn that the earth was round? Indeed, in this line we might ask pertinent questions by the score. We would get but one general reply —the world was not prepared to obtain this knowledge sooner than it did,—the upper stories of a structure cannot be built before the foundation and the walls of the lower stories are completed. The perfection of meteorology, whereby we become familiar with that stratum of nature between the heavens and the earth, depended upon the perfection of other things which lead up to it. Years ago when we studied physical geography we thought that we knew, or must know about all that there was on this subject.

Wise men had given it their studious attention, but studious attention was of little avail without the means of obtaining facts all important in the matter. Other able men must first advance in the department of electricity and perfect that, give us the telegraph and all the other necessary paraphernalia for gathering the important facts, whereby the transmission and the use of data was made practical. Wonderful are all the necessary perfected steps which lead up to this important branch of human knowledge; indeed do they come under the head of "too numerous to mention." The clear intellect, even with the unaided eye could obtain a very complete knowledge of the heavens. By the aid of ships, and a few instruments, whereby the unknown seas could be navigated, we could discover the unknown continents, but in order to discover these regions which lie between the heavens and the earth—between the celestial and terrestrial spheres, we must wait many long centuries until we had so subdued the forces of nature to our control that we could use them to conquer these other forces which were apparently beyond our reach. But step by step we were lead up to them, and to-day, through these acquired agencies, the laws which govern the forces which form this middle domain of nature and which have such an influence upon us, are as well known as the terrestrial conditions with which we are so familiar; that is, we are, or can be familiar with them on the same principle that we are familiar with other things about us—by seeking information in the right direction and from the right source. "Where may this be found?" it may be asked. On the Weather-Map. The Weather-Map followed up day by day will reveal all to us; and it is the medium and the only medium whereby we may understand this subject.

"But what about physical geography?" may be further asked. Physical geography most certainly should embrace meteorology, as a department embraces a bureau, but meteorology up to within a few years, had no knowledge of the Weather-Map—indeed even late editions of physical geography make no

mention of the map, and yet this wonderful instrument has been in existence, here in the United States since 1870. At first, however, it was necessarily crude, but about 1876, or thereabout, it had reached quite a degree of perfection, and yet the persons whom the world would have thought would have been the most eager to seek revelations from it were the very ones to neglect it and continue to publish works upon the general subject, "physical geography" with little or no attention to this all important branch which alone can impart the necessary information.

Physical geography so far as it pertains to meteorology, without the knowledge that may be derived from the Weather-Map, is comparatively of no value, and at this age of the world better be dropped altogether.

The Weather-Map is a most peculiar thing. It does not reveal its secrets like a book, or even like a picture; for this reason few pay much attention to it, and therefore fail to see and perceive the wisdom that it imparts. It must be followed up, day by day, week by week, month by month, year by year; and as it is never twice alike—always different—showing the dominant force in nature for the time being, these forces never bearing the same relation to each other—man can study this wonderful Geography of the Atmosphere for all time, and to the end of time continue the study; and then, after all this study, the changes which take place will be as new and fresh to him as the next new face he meets in his daily walk. Although physical geography should include meteorology, by reason of the map, the sub-department becomes independent and all important by itself. We will study physical geography when we wish to know about the terrestrial conditions which surround us but when we wish to know something of what we may term the middle stratum, the bridge between earth and heaven, we will consult the Weather-Map. This is speaking of things as we find them to-day. The physical geography of the future, however, will include this. The great wonder, however, is that those who are authors and publishers of physical geography have so long ignored so much light, and the only medium whereby light and information could be gained on so important a subject. All persons should be informed in regard to the Weather-Map, and all intelligent people should be able to know something practical about a storm, when it is approaching, from what quarter, when and how it is likely to clear off, and more than this, should be able to protect themselves against all impostors, and all silly, erroneous, and superstitious sayings on this subject. And, by-the-way, there is no department of nature so replete with these sayings, as the weather, for the simple reason, as seen in all departments of human knowledge, where there is darkness then will there be all degrees of foolishness, from the harmless to that which is most injurious. When man has no real knowledge he readily resorts to the imagination, and the lower his nature and the greater his ignorance, the lower his conceptions of cause and effect.

The Weather-Map with its wonderful revelations came late to the world, yet the authors of our physical geographies should have been ready to receive it when it came, but they were not. Their influence by this time might have added

much light and corrected many wrong impressions, but they choose rather to ignore the light than to seek it and profit by it.

To-day, meteorology is still taught, or better, attempted to be taught, on the old plan; might as well undertake to teach pupils geography with the books and light of the fourteenth century as to attempt, to-day, to teach them meteorology without the Weather-Map. The reader may think I am too eulogistic and simply trying to "write up" something beyond its value. All I have to say to such as may think so, is, to study the map thoroughly and note its revelations day by day. Before taking the map, however, let one ask himself what he knows about the weather. After a careful study of the map for a year or two let him compare notes with what he then knows, and what he knew before. If the map has not revealed his former ignorance then he has not been a good observer and made the best use of his time. The great important thing the map reveals to us is that the areas of high and low barometer move across the country on general lines from the west towards the east. "Low," or low barometer is the governing factor, and may be likened unto the valley, while "High" represents the hill. The currents of atmosphere are from the "High" to the "Low." The cause of low-barometer we ascribe to concentrated heat. The great property of heat is to expand or rarify the particles of matter with which it comes in contact. The air at the point "Low" is rarified: the result of this is the inrushing of cold currents to supply the place of this air so rarified and makes what we call *the wind.* So the movement of atmosphere is always towards "Low." The great reservoir of air is the area of "High" or high-barometer. The air rushes along the surface of the earth, from all points of the compass, from "High" towards "Low"; here, by the force of heat, it ascends till it reaches the upper stratum of the atmosphere. From here, judging from the upper movements of the light clouds, the direction is outward from the centre "Low" towards the "High," or better, the upper part of the column "High" to supply the withdrawing of the atmosphere from the bottom of the column "High."

The surface current, or what we term the wind, is, on general lines, from "High" to "Low"—the upper or atmospheric currents from "Low" to "High." At the surface of the earth from the cold to the hot, at the surface of the atmosphere from the hot to the cold—the vacuums as it were being reversed. On the surface of the earth "High" is the highest, "Low" the lowest, while at the top, or upper stratum of atmosphere the highest point would seem to be at "Low" —"Low" the highest, "High" the lowest. When we speak of the movement of the atmosphere, its movement along the surface of the earth, or its terrestrial movement is to be understood. The movement is from the "High" to the "Low." This being the case if "Low" is on a high line of latitude, say at 50° north, or beyond, we will have south winds; and south winds are warm; that is, winds from the far south; the further they are from the south, and the further they travel over the country, the warmer they become. That is why it is, in summer time, often warmer along the northern line of the United States than at the south. But although these areas of Low-barometer travel from the west

towards the east they do not do so on any regular line or course. They enter the territory of the United States at various points. On the Pacific their most objective points are above and below Cape Mendocino, the extreme western point of our western border.

This, however, is a mere general statement, for they never enter twice alike and vary with the season and seasons. As a rule they enter and cross the country on a higher line of latitude during the warmer than during the colder months. Others enter at the southwest, or through Mexico and Texas; while still others enter from the region of the West Indies, sometimes striking quite far inland; at other times merely skirting the coast. These latter ones, from want of stations in the West Indies we have very little forewarning of. Although "Low" travels from the west towards the east, it often in its passage, travels on lines almost due north and south for twelve or fifteen hundred miles, and perhaps more. For want of the proper stations we cannot trace its full course. So these "Lows" that come up from the south are undoubtedly ones that are travelling on some erratic course. These areas of high and low-barometer, "High" and "Low," in addition to travelling as above stated, also travel in belts around the world, and all the while vary as to the territory they cover. At times "Low" will be in the north, "High" central, and another "Low" in the south; or we may have "Low" central, with "High" each side. It is always changing, and these changes produce the changes of the weather from hot to cold, wet to dry; and all the changes are the result of the relation which these two powers "High" and "Low" bear to each other.

The wind being towards "Low," it follows if "Low" is in the north we will have south winds, if in the south, north winds, and these winds partake of the qualities of the locality from which they come. There are times, however, when the north winds will not be very cold nor the south winds very warm, and this will be when these respective winds come from an area of high-barometer that is not very far away. If "High" lies immediately to the north, the north winds cannot be from a great distance north, and if "High is immediately to the south the south winds will not be from far south, therefore will have little opportunity to become heated. "High" is like a great mountain ridge; it is the mountain ridge of the atmosphere. The wind is from the centre of the ridge or highest point of "High;" from the centre outwards, so on the north side of "High" the wind will be towards a north "Low," while on the south side it will be towards a south "Low," etc.

The lines which these areas of "Low" make across the country are infinite, never twice alike; and although their general course is from the west towards the the east, or towards the rising sun, they at times travel due west, but it is always towards the latter part of the day or at night. So soon as the sun reappears in the east and establishes its centre of heat "Low" immediately advances towards it. These areas of Low-barometer not only vary in direction, but in speed, extent and intensity, sometimes being very small, not more than a few hundred miles in diameter, then extending over one-half of the United States and at times

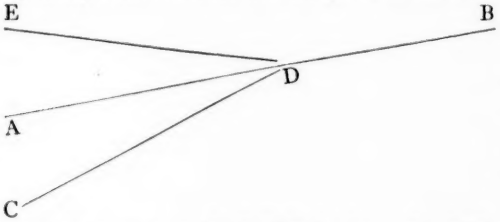
they travel not more than a hundred miles in twenty-four hours, at other times they will travel fifteen hundred miles in the same time. And herein is the trouble as regards "indications." We cannot, at least at present, know in advance the direction, the intensity, the speed or the spread, the storm-centre "Low" will take; it is never twice alike nor does it have any periodic similarity. In meteorology there are no special rules to guide us, and that which is past does not, only in a general way, help us much as to what is to come. The study of the map, however, is far more satisfactory than any "indication." But the map can only be studied with satisfaction when near at hand. We can, however, with slight cost, have a substitute which will be nearly as good, and far better than none. The substitute is a skeleton map. Let the people throughout the country have rough outline maps of the United States, divided into squares on the lines of latitude and longitude. Let the size be regulated by convenience. The squares to be designated by letters or figures. The report then to be sent from headquarters at Washington; not only once a day, but say at morning, noon and evening, indicates where the "High" and "Low is, their number, (if more than one), direction, and movement since the last report. Let the public once get accustomed to this system and they would not think of relinquishing it, nor of turning back to even the present system, much less to the ante-diluvian *no-system* which we received from the old school of "physical geography." The new school of physical geography will embrace the "Weather-Map" as its all important source of information in this department.

As the storm-centres "Low" appear in our west and disappear off the eastern coast and are tracked across the ocean to Europe, so far as we know always disappearing in the east, the inference is that they encircle the earth. We cannot at present prove this, but as we can trace them a quarter the way around the earth and they disappear and reappear in this manner it is not unreasonable to believe that they encircle the earth. The question is often asked, where do storms come from? This idea of encircling the earth being true they do not come from any specified place or quarter, and have no more beginning or ending than a circle, and of them it may well be said, they come from *nowhere*, if the phrase may be understood to conform to the statement in regard to their course and origin. They are ever present on the surface of the earth, varying in shape, in size, intensity, compass and direction, but always having an existence, ever coming and ever going. Late in the season, when we have what is termed "settled weather," as many storm-centres pass us by as during the "inclement season," but they pass us on different lines. During the warmer months a greater number pass us on a high line of latitude and carry heat far to the north, making the north country productive.

Before the advent of the Weather-Map we could not understand that marvel of the year "Indian-summer." The map shows us that it is the effect of an autumnal "Low" on a high line. During the colder months more "Lows" travel on low lines of latitude, making it cold at the south. The "Lows" that produce the most storm, rain or snow, are those which travel on diagonal lines.

Whether "Low" will produce rain or snow depends upon its latitude as well as upon the season and the latitude of the section of the country over which it passes. To enumerate all the changes of "High" and "Low," and to show the effects which they have upon the climate of the country would fill volumes. As the changes are infinite the variety must be in proportion; only by the Weather-Map can we be aware of these changes and study their effects. Until we had this wonderful map we had little or no conception of the meteorological phenomena of the world. For example the tornado. The old "physical geography" system had various names for this violent phenomenon, such as *cyclone*, *hurricane*, and *tornado*, and undertook to draw a line between them, giving certain characteristics to one which it did not give to the other. The map reveals the fact that they are all one and the same, and that they proceed from "Low," and under certain conditions of "Low" the different localities of the earth will have the severe storm which may be called by either of these names. The mere description of one of these storms might fill volumes, but from them we gather little or no knowledge of their cause, we only learn of the effect, but follow up the Weather-Map and their cause as well as their effect will be fully revealed. The tornado comes from "Low" and always takes place in the track of this factor, which for short we term "Low." One "Low" passing over the country will not produce the effect, any more than a little fire would in a short time heat a large room. We must have a succession of "Lows" on a high line, or relatively high line, in order to obtain, through the south winds, the necessary amount of heat. Every "Low," even *high* "Low," will not produce a tornado, if it did we would not only have one every day but every hour of the day all over the country.

The map reveals the fact that the violent wind-storm we call Tornado or Cyclone, when it occurs will always be in the track of "Low" and generally at an acute angle thereto, say an angle of about 15° or 20° to the line of the track of "Low." Let the centre of "Low" one morning be at A; the next morning at B. The tornado will take place on the line C D or E D, or even between the angle C D E, in the track of "Low."



Volumes have been written upon the subject of Climatology, but the subject will never be understood until we seek the proper information from the Weather-Map. By this map we can understand the Climatology of the United States as never before, and when the rest of the world is as well supplied in this respect as the United States we will then and not till then understand the full climatology of the world. The climate of the eastern and western coasts of continents is quite different. Under the old system, which is still present with us, this is all said to be due to the warm currents of the ocean. But the "Weather-Map"

now steps in and reveals additional light; and, while at present, from want of stations, we cannot deny but what the warm ocean-currents have something to do with the mildness of the climate, say of our northern Pacific Coast, it does reveal to us that it is not all owing to these currents, but that the position of "Low" has much to do with it and perhaps more than ocean-currents. Land retains heat better than water. To the north of the United States there is a vast domain of land. The map reveals to us that one belt of "Low" passes far to the north of Cape Mendocino, and that the line of this belt varies with the seasons, while the currents remain about the same the year round. Now if the currents remain stationary and the course of "Low" varies with the season it would seem to be good proof that this phenomenon was independent of these currents. This same phenomenon reveals the cause of the peculiar climate of California; a revelation that was not in the power of the old physical geography system to make known. From early in the season till towards the winter months the north "Low," the one that enters the coast to the north of Cape Mendocino works far to the northward. The one that enters the coast to the south thereof also advances northward. From winter to spring these two belts work southward with the Sun. The higher the Sun in the ecliptic the higher the belt of "Low." "High" lies between these two belts and a good part of the year is over the region of San Francisco. The course of these belts varies, for this reason the seasons of this section of the country vary and are never twice alike; but as a rule "Low" passes over this locality quite often from December to April. The higher the Sun in the ecliptic the higher the line of "Low," and the higher the line of "Low" the warmer the temperature on a high line of latitude, and the reverse. Until we had this new revelation it was not possible for us to understand these phenomena of nature. By these discoveries, which come through years of patient toil and advance towards perfection in other branches, we are able, as never before, to comprehend the system of nature under which we live.

Of course this system comes generally under the head of physical geography, and physical geography should include meteorology as a department includes a bureau. But the department, strange to say, has ignored the bureau, and the perfection of the bureau has come through sources quite unlooked for; and though disregarded by the department has quietly advanced towards perfection most surprising. It would be wise in the department to now accept the bureau. As the case stands at present the bureau has fast exceeded the department—a most peculiar circumstance in the annals of science.

It is to be hoped that more and more attention may be paid to this subject. What meteorology now calls for is more and more stations in localities where they will be of the most value. The more we have the more valuable the system becomes, and it would seem that it was time the nations of the earth took this subject in hand. The more universally it is extended the greater the blessing it will confer upon all, the small territory as well as the large, the large as well as the small.

The great middle stratum of our universe is what we particularly want knowl-

edge of. We want to understand the geography of our atmosphere as well as the geography of our terrestrial globe and that of the distant heavens. On this knowledge depends more blessings than is at present realized by the world. The little instrument known as the "Weather Map," strange as it may seem, is destined to play a most important part in the welfare of the race. The more we contribute to the knowledge of this great undiscovered country, between earth and the heavens, the more happiness we confer upon ourselves. Let the lines of stations advance until we have at least one on a square of two hundred miles—the more we have the better the work, and the greater our knowledge on the subject, the wiser and more reliable weather-prophets we may become, and the greater the blessing we may confer upon mankind.

WASHINGTON, D. C., July, 1884.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	June 20th to 30th.	July 1st to 10th.	July 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	68.	62.	66.	. .
Max	96.	85.	97.	. .
Min. and Max	82.	73.5	83.	. .
Range	28.	23.	31.	. .
TRI-DAILY OBSERVATIONS.				
7 a. m.	72.4	71.3	71.7	71.8
2 p. m.	86.5	87.0	84.8	86.1
9 p. m.	73.2	75.4	75.4	74.7
Mean	77.4	77.4	76.4	77.1
RELATIVE HUMIDITY.				
7 a. m.	.89	.80	.88	.86
2 p. m.	.69	.55	.70	.65
9 p. m.	.85	.77	.85	.82
Mean	.82	.71	.81	.78
PRESSURE AS OBSERVED.				
7 a. m.	29.034	28.965	29.023	29.004
2 p. m.	28.990	28.948	28.991	28.976
9 p. m.	28.993	28.949	29.020	28.987
Mean	28.006	28.954	29.011	28.989
MILES PER HOUR OF WIND.				
7 a. m.	. .	9.8	. .	. .
2 p. m.	. .	12.6	. .	. .
9 p. m.	. .	7.5	. .	. .
Total miles	1630	2413	1964	6007
CLOUDING BY TENTHS.				
2 a. m.	4.4	4.7	4.6	4.6
7 p. m.	4.7	2.5	4.5	3.9
9 p. m.	2.6	3.0	4.3	3.3
RAIN.				
Inches	2.29	1.78	2.73	6.80

The month included in this report has been warm and moist. While the rain-fall has not much exceeded the average at this season the previous saturated condition of the soil has made it seem unusually wet. To this humid condition the high temperature has added a feature which has made the air quite oppressive and the warm, still nights have not given the usual chance for refreshing sleep. As regard the storms most of them have occurred at night in the latter part (i. e. from 12:00 to 3:00 o'clock A. M.), and at this station they have come from the north and northeast. There have been abundant electric disturbances, and the wind has been strong but not reaching the tornado violence.

Lightning struck in many places, doing some damage. These conditions have favored the growth of corn and no one has ever seen it grow more rapidly, even in Kansas.

BOOK NOTICES.

HISTORY OF THE THIRTY YEARS' WAR: By Anton Gindely. Two volumes; Octavo, pp. 912; Illustrated. G. P. Putnam's Sons, New York, 1884. For sale by M. H. Dickinson, $4.00.

This work, notwithstanding its dimensions, is a condensed history of the war carried on between the Roman Catholics and Protestants in the first half of the 17th century, commencing in 1618, with the insurrection of the Bohemians, and ending with the peace of Westphalia in 1648. It is divided into three parts: The first describes those events which gave immediate occasion to the out-break of the war; proceeds thence to relate the history of the Bohemian insurrection, the judicial proceedings and confiscations which follow, and the consequent re-actionary measures of religious reformation. It is doubtless the most reliable and at the same time interesting account of this celebrated struggle that has ever been written; for aside from the mere facts of history the author devotes many pages to accounts of prominent individual actors in the drama, such as Gustavus Adolphus, Ferdinand II, Cardinal Khlesl, the Palsgrave Frederic, Maximilian of Bavaria, Prince Waldstein, and Cardinal Richelieu. These portrayals of life are especially valuable as showing the peculiarities of the intercourse between the people of the time.

The discussion of the subject is full and free, and enables the reader to rightly judge such opposing characters as the Romanist Ferdinand II of Bohemia, and the stern and unrelenting protestant, Gustavus Adolphus of Sweden, who devoted his whole life to carrying forward the principles of his church and faith.

The whole war seems to have been, with the exceptional ambitions of various sovereigns, a contest for the control of the religious doctrines and worship of the people without regard to the feelings and wishes of the people themselves. Both

sides shared this idea and were equally intolerant of sects that did not agree with either.

This war commenced just a century, or, to be exact, ninety-eight years from the date of Luther's nailing his theses to the church door at Augsburg, and was the natural outgrowth of the revolution led by Huss and his fellows. The evolution of religion and religious beliefs and doctrines has steadily proceeded through all history and will continue to do so until the grand final culmination is reached, which no man can foresee, and this terrible war was but one chapter in the course.

The typography, paper and binding of these volumes are excellent.

TIMES OF LINNÆUS: By Z. Topelius. 12mo., pp. 394. Jansen, McClurg & Co., Chicago, 1884. For sale by M. H. Dickinson, $1.25.

This is the fifth of a series of Swedish historical romances by Prof. Topelius, of the University of Finland, entitled "The Surgeon's Stories," those preceding it having been "The Times of Gustav Adolf," "Times of Battle and Rest," "Times of Charles XII" and "Times of Frederick I."

The marked characteristics of these works are the enthusiasm of the author and the correctness of his portrayal of prominent actors and events described in them. Of the volume under present consideration, it is perhaps less exciting in most respects than either of the others, but at the same time, it is full of interest and instruction concerning the period involved. It is divided into two parts "The Princess of Wasa" and "The Free-Thinker." In the first, as the author suggests, "A glance is cast at the inner side of the middle of the eighteenth century, with the whole bubbling cauldron when the ideas of a new period were boiled soft, to be eaten scalding-hot by the revolution of 1789—the time of Adolf Frederick, Louisa Ulrica, Tessin, and Linnæus, the childhood of Gustav III and the period of the hoop-skirts." Linné, the great naturalist, afterwards Latinized to Linnæus, makes the subject of a chapter or two, otherwise his name is not mentioned. In the second he does not appear at all, but other characters of the time make up the story.

One more story completes the series. It is entitled "The Times of Alchemy," and will doubtless equal any of its predecessors in interest.

THE ELEMENTS OF RHETORIC AND COMPOSITION: By David J. Hill, LL.D. 12mo., pp. 270. Sheldon & Co., New York and Chicago, 1884. For sale by M. H. Dickinson, $1.00.

Dr. Hill is a well known writer of text books on rhetoric and logic, having published treatises on each of those subjects for use in the schools, as well as other similar works. The present book is designed as a practical introduction to English composition, and to furnish a compendium of rules for guidance in the art of writing. The learner is conducted, step by step, through the entire work

of writing a composition, including the selection of a subject, the accumulation of materials, their arrangement, the choice of words, the construction of sentences, the variation of expression, the use of figures, the preparation of manuscript, the criticism of the completed production, and the classification of it as a specific form of composition. The exercises are full and carefully prepared; a copious index and glossary are also found. The whole work is better adapted to the class-room than most books of the kind, and we should like to see it adopted as a text-book in the schools of this State.

A COUNTRY DOCTOR: By Sarah Orne Jewett. 12mo., pp. 351. Houghton, Mifflin & Co., Boston. For sale by M. H. Dickinson, $1.25.

This, the first continued effort at novel-writing by Miss Jewett, is a decided success. Her previous works have been confined to short stories which have attracted much attention and have been read with interest by all readers. The plot of the story is simple though well constructed, and the characters and incidents faithfully drawn. Being a doctor's daughter she has been able to weave in many familiar incidents of a doctor's life and to give to her heroine, who becomes "the country doctor" of the story, a reality of character and conduct not often found in a young lady's book. The tone of the work is healthful and the style free and attractive. It can but have a good influence wherever read.

BARBARA THAYER: By Mrs. Annie Jenness Miller. 16mo., pp. 180. Lee & Shepard, Boston, 1882. For sale by M. H. Dickinson, $1.00.

Mrs. Jenness is well known in the east as a former popular lecturer, who since her marriage has taken to the congenial pursuit of novel-writing. This is her first work and it seems to have been unusually well received. The author has carried into the book her best thoughts in the line of her platform teachings, which were always devoted to social and educational topics. She is earnest and decided in her treatment of the marriage question, and handles some very delicate points in a decisive and frank manner, at the same time with great natural refinement. All of the characters are carefully and skillfully drawn, and whether we fully agree with her or not in the disposition of the case, we must all admit that her ideal is lofty, and that she maintains her point faithfully and with firmness to principle throughout.

SCIENCE LADDERS: By N. D' Anvers. 12mo., pp. 439. G. P. Putnam's Sons, New York, 1884. For sale by M. H. Dickinson, $1.50.

This volume is made up from the series of six smaller ones which we have noticed as they were published separately under the titles respectively: "Forms of Land and Water," "The Story of Early Exploration," "Vegetable Life,"

"Flowerless Plants," "Lowest Forms of Water Animals," "Lowly Mantle and Armor-Bearers." The series is intended to teach the great laws of nature in language simple enough to be intelligible to every child and yet with accuracy and completeness. It aims at awakening the powers of observation and reasoning so that pupils and teachers may be fellow-workers from the start. How well these objects are carried out can be judged from the titles of the different papers, and the fact of the series having had a large and wide-spread sale.

FIFTH AVENUE TO ALASKA: By Edwards Pierrepont, B. A., with maps. Octavo, pp. 329. G. P. Putnam's Sons, New York, 1884. For sale by M. H. Dickinson, $1.75.

This is a vivacious and sketchy account of a four months' trip by rail, steamer, stage and on horseback from New York to the Pacific coast, up that coast to Alaska, "reaching a latitude, where there was no night and where the Sun rose within four hours after he set." Thence by way of Victoria and Puget Sound to Portland, and then home by way of the unfinished Northern Pacific R. R., making some twelve thousand five hundred miles in all.

As the son of Hon. Edwards Pierrepont the author had unusually good advantages for seeing all that was worth seeing, and especially of meeting with many intelligent and dintinguished men who were free to impart useful information to such travellers. To describe such a book would be a tedious task; suffice it to say that the writer touches upon almost every topic that could be wished, and in many instances gives valuable information on points little understood in the East.

The book is very handsomely gotten up and the maps especially are carefully and accurately prepared.

OTHER PUBLICATIONS RECEIVED.

Ninth Annual Report of the Railroad Commissioners of Missouri for 1883. *Chicago Popular Monthly*, August, 1884, $1.50 a year, Chicago Popular Monthly Co. Primiere Application a Paris, En 1883, de L'Assainissement Suivant Le Systéme Waring, par Ernest Pontzen; Prix 2 francs, 50 cents, Paris Librairie Polytechnique, 1884. Economic Tracts No. 13, The Work of a Social Teacher, a memorial of R. L. Dugdale by Edw. M. Shepard, Society for Political Education, N. Y., 1884. Alta della Societa Toscani Scienze Naturali, Vol. 4. Professional Papers of Signal Service, No. 13, Temperature of the Atmosphere and Earth's Surface; prepared under direction of Major-Gen. W. B. Hazen by Prof. William Ferrel; Government Printing Office, 1884. Report of Kansas State Board of Agriculture for month ending June 30, 1884, Wm. Simms, Secretary, Topeka, Kansas, 1884. Illustrations of the Durham System of House-Drainage, Guy H. Elmore and Geo. R. Baucus, Kansas City, Mo. *The Young Meteorolo-*

gist and Antiquarian, Vol. 1, No. 1., T. H. Page, Wheaton, Ill., 75 cents a year. Catalogue of Monticello Ladies Seminary, 1884, Godfrey, Ill.; address Harriet U. Haskell, Principal, or Rev. Truman M. Post, D. D., President, St. Louis, Mo. Changes in the Currents of Ice of the Last Glacial Age in Eastern Minnesota, by Warren Upham. Circulars of Information of the Bureau of Education, No. 3, 1884, articles by Chas. Warren, M. D., and appendix by J. L. M. Curry, LL. D., Washington, D. C., 1884. Johns Hopkins University Studies, second series: Institutional Beginnings in a Western State, by Jassa Macy, A. B., July, 1884. The Minnesota Valley in the Ice Age, by Warren Upham, Salem, Mass., 1884. Circulars of Information of the Bureau of Education, No. 2, 1884, by Julius Ensign Rockwell, Washington, D. C., 1884. *Humboldt Library*, No. 38, double number, 30 cents, Origin of Species by Means of Natural Selection, by Chas. Darwin, M. A., F.R.S., in two parts, Part I, publisher J. Fitzgerald, New York. *American Meteorological Journal*, July, 1884, W. H. Burr & Co., Detroit, Mich., $3.00 per annum.

SCIENTIFIC MISCELLANY.

RECENTLY PATENTED IMPROVEMENTS.

J. C. HIGDON, M. E., KANSAS CITY, MO.

CUFF-HOLDER.—This invention consists of a modified form of the common safety-pin, having a special button attached to a flat sided hook playing through the guard-arm and adapted to hold the cuff in proper position upon the wrist, the pin being attached to the inside of a coat-sleeve and the bottom used in supporting the cuff.

A flat-sided guard-hook is constructed to operate loosely in an opening through the guard-arm, and having suitably secured to the end opposite the hook, a button of any approved construction.

In operation the cuff is placed on the wrist, and is held in the desired position by inserting the pin-point through the sleeve or lining of the coat or other garment; the pin-point is next placed within the hook, the spring of the pin acting through the hook and button-standard, presses the button to the cuff and in this manner the cuff is securely held in place.

The button may be permanently secured at a proper distance to the guard-plate or arm, but in that arrangement, however, the cuff would not be held sufficiently secure and would wabble, hence the button standard-hook is but loosely attached, so that the spring will draw the button down on the cuff and hold the latter more securely than in the arrangement with the permanently fixed button.

The pin is not only a pin, but it acts to hold the button securely pressed to

the cuff, the hook and its opening through the plate are constructed with one or more flat sides to prevent the hook from turning, thereby causing the hook of necessity to remain in proper position to receive the pin.

The entire device, including the opening through the guard-arm except the guard hook and button-standard, may be constructed of a single piece of wire; the hook and button-standard are preferably made of a single piece of wire, so coiled to form an oblong flat surface, and afterwards bent to the shape of a hook. The inventor is Mr. Norman H. McAllister, of Kansas City, Mo.

COMBINATION WRITING INSTRUMENT.—This invention relates to improvements upon that class of convenient pocket instruments in which there is combined a pen or pencil, a self-inking rubber stamp, a rubber eraser and a steel knife eraser, and it consists principally in fixing within the upper end of an ink-pad shell the before-mentioned erasers, and in so constructing the different parts that the instrument will be of a uniform size throughout its entire length.

This desired end is accomplished by stamping the inking-pad and the stamp shells, each into a comparatively semi-circular form, so that when the two are closed together they form a nearly perfect hollow cylinder.

In operation, by pressing upon the side of the ink-pad shell opposite its hinge and upon the eraser end thereof the slight projection upon the upper end of the stamp-shell is sprung from a slight indenture at the base of the erasers, upon the upper end of the before-mentioned ink-pad shell, and by reason of the coiled springs the parts are thrown into a position for using the rubber stamp which is pivoted to the upper end of the main shell.

The end of the pad-spring bears upon the latter surface, and the end rests against the inner surface of the ink-pad. The knife-eraser is provided with a cylindrical head by means of which it is fixed within the upper end of the ink-pad shell, and the rubber eraser is cored out so that it may fit over end protect the knife.

By constructing an instrument in the manner and of the form above described, the manifold utilities thereof will need little explanation: for instance, writing may be executed with the pencil and erased with the rubber; the pen or the stamp may be used and if desired their impressions erased by means of the steel scraper. The inventor is Mr. C. Blitz, of Kansas City, Mo.

AUTOMATIC CAR COUPLING.—The object of this invention is to provide a coupling for railroad rolling-stock that will obviate the necessity of the operator going between the cars; and it consists of a draw-head that is provided with a narrow vertical chamber in which is journaled a semi-rotative disk formed with a segmental coupling-hook that is adapted to be automatically thrown out of balance by the entering link; the heavier weight of the disk upon the side opposite the segmental coupling-hook keeps the said link firmly within the draw-head, and it consists, further, of a bail and cranks attached to the disk-journal, whereby said disk is rotated for the purpose of grasping and releasing the link.

Cords or chains are attached to this bail, so that it may be operated from each side of the car.

A draw-head is provided, in addition to the flared opening for the link, with a vertical circular disk-chamber, open at the bottom and closed at the top. The rotary coupling-disk is provided with the before-mentioned segmental hook, which, when the said disk is rotated by the link striking the inner inclined edge of the annular slot, acts as a coupling-pin, and the said link cannot be withdrawn until the disk is turned in an opposite direction.

The link-opening, at its inner extremity, is in the form of a right-angle or a hypotenuse, and the link, upon entering the opening, is guided by the inclined sides of the angle to the apex thereof, at which point the said link, resting near its center upon the convex lower side of the aforesaid opening, should lie in a parallel position.

Now, by operating the chains, which are attached to the car, the bail, to which such chains or cords are fastened, is raised, and, the same being jointed to the disk-journal by means of the side cranks, the coupling-disk is rotated slightly, and the link may then be withdrawn; but when a link is already within the draw head, and it is desired to couple with a draw-head that is of a different height, the outside end of the link may be easily raised or lowered by reason of the weighted side of the disk, resting upon its inner extremity in the angle of the link-opening.

By manipulating the weight of the disk in making a coupling, the operator, aided and by reason of the before described inclined surfaces at the end of the link-opening, may hold the link parallel with the draw-bar, or it may be slid forward and downward, or forward and upward, as desired.

Stops upon chains prevent them from being drawn up so high that they cannot be readily reached from the ground. Handholds also are attached to the ends of the chains for convenience.

A stop, upon the end of the car a short distance above the bail, prevents the opening of the coupling until the bail is lifted by means of the chains.

A stop-lug upon the disk prevents the same from rotating so far as to allow the cranks to form a line with the bail-arms. The inventor is Mr. W. H. Holley, of this city.

BALANCING ENGINE SLIDE-VALVES.—A very simple idea, yet an efficient and practical device, has been patented by Mr. James Bewsher, of this city, for overcoming the justly condemned pressure exerted by the steam upon the back of a steam-engine slide-valve.

To the back of the valve in bearings that are cast thereon, is journaled midway of its length, an equalizing-bar, having a short link journaled to each extremity, one of such links extends downwardly to the bottom of the steam-chest where its lower end is securely journaled, the other extends upward and is pivoted to the piston of a small cylinder upon the top of the steam-chest.

When the steam is pressing downwardly upon the valve, it at the same time

presses the piston of the balancing-cylinder upward, and as each presents very near the same surface to the pressure, it follows that the valve will be balanced and can be reciprocated by an extremely small power.

The outer ends of the connecting links before mentioned, remain stationary, but as their inner extremities are connected to the equalizing-bar, they, of course, are caused to oscillate in a vertical line, and as each has a similar radius, the balancing piston is devoid of motion.

VIRGILIAN PROVERBS.

F. J. MILLER.

It seems natural to man to delight in axioms, those formulæ of thought which bear the stamp of truth upon the surface, and which no one can call in question. And perhaps it is this natural delight which leads us to crystallize into proverbs those other principles which, though not axiomatic, are still so broadly founded in reason and experience as to be generally admitted to be true.

The pleasure we experience in meeting these proverbs, however disguised they may be in poetical garments, is that of being on familiar ground. We, too, have experienced or observed the same thing, and this common thought at once brings us into intimate relations with our author; we can strike hands with him and say, "Yes; I know that." The author who utters for men their own thoughts is the most appreciated, the most popular, the most quoted. The popularity of Virgil may be explained, at least in part, on these grounds. The ardent student often finds with delight that the author for a moment leaves that which is new and strange and greets him in his own tongue. We cull a few examples out of the riches before us, choosing almost at random. Our poet sings:

"Quid non mortalia pectora cogis, auri sacra fames?"

and again,—

"Improbe amor, quid non mortalia pectora cogis?"

and our observation daily tells us that the same "fatal thirst for gold," and the same "base passion" drive men to all extremities to-day.

The stately utterance of the Trojan hero,—

"Dolus an virtus, quis in hoste requirat?"

has retained its substance, though changed in form, in the English proverb,—

"All's fair in love and war;"

and we recognize the "courage of despair" in

"Una salus victis, nullam sperare salutem."

Our English proverbs are often open to the criticism of inelegance and slang, Not so the Virgilian. While the elegant Mantuan comforts the love-lorn swain in this fashion, "Invenies alium, si te hic fastidit, Alexim,"—his English cousin, with more force than elegance, will only say: "There are as good fish in the sea as ever yet were caught."

How vividly reproduced are such expressions as "David in Saul's armor," "sailing under false colors," "wearing borrowed plumes;" and that other proverb which, though rude, is still at the foundation of all success,—"Let every tub stand on its own bottom,"—how bitterly the meaning of them all is realized in the cry of the luckless Trojans,—

"Heu nihil invitis fas quemquam fidere divis!"

Against the "Judas kiss" and the "wolf in sheep's clothing" comes the warning cry of Laocoön,—

"Timeo Danaos et dona ferentes."

Those were genuine men, and not Trojans merely, in that old ship race off the coast of Sicily, for then

"Hos successus alit, possunt, quia posse videntur;"

and just as truly to-day, "Nothing is more successful than *success*." Thus we may see in Virgil's pages the true spirit of stoic indifference,—

"Quid quid erit, superanda omnis futura ferendo est;"

and the "ruling passion,"—

"Trahit sua quemque voluptas;"

and the lightning-like speed of rumor,—

"Fama, malum qua non aliud velcuis illum."

These comprise only a few of many similar passages. By means of these, and topics of like nature, an excellent review of Virgil may be made. Thus, if the student be directed to pick out all the proverbs, the similes, the flowers, the Roman customs, or the different uses of any word, he will undertake his work with all the ardor of an explorer, and, without knowing it, will obtain such a knowledge of the author as he could get in no other way.—*Journal of Education.*

THE THREE GENERA OF THE GREEKS.

F. A. JONES.

The Diatonic Genus among the Greeks was divided into several modes, or which, in our modern terminology, are denominated scales. They comprised the following: the Dorian, the Phrygian, the Lydian and the Mixo-Lydian; the first of these commencing on D, the second on E, the third on sharp F and the fourth on G, and each of these modes had a corresponding or collateral mode, distinguished by the prefix Hypo, signifying under, as Hypo-Dorian, Hypo-Phrygian, Hypo-Lydian and the Hypo-Mixo-Lydian. These Hypo modes were situated at a 5th above or its inversion a 4th below the original four modes which were termed authentic in contradistinction to the Hypo modes which were termed Plagal from *plagios* signifying sideways or athwart; thus for example, the Hypo-Dorian may be reckoned from A, consisting of natural notes, the Hypo-Phrygian from B including C sharp and F sharp, the Hypo-Lydian from C sharp including D sharp, F sharp and G sharp, and the Hypo-Mixo-Lydian from D containing B flat. The first of these genera is known as the Diatonic genus; this

admits of the normal notes of the key in which a musical passage is cast, that is to say notes that accord with the signature of each key in modern music.

Through inflection or change by sharps or flats, notes bear the same relationship to their key-note. Thus, for example, the sharps which characterize the key of E or the flats that distinguish the key of E flat cause the notes of these keys to be brought into the same relationship with their key-note as do the natural notes to the key of C. Sharps or flats then, may exist in the Diatonic genus, but those only which belong to the signature of the key. In order to elucidate my subject more clearly, I may here endeavor to explain the term Diatonic, which is derived from two Greek words, *dia* signifying through, and *tonos* a tone or a sound, therefore this compound word signifies, literally, through the tones or sounds, and a Diatonic scale may be defined as a series of eight notes, which proceed alphabetically from any note to its octave, by five tones and two semitones, this scale is divisible into two sections known as Tetrachords; this again has a Greek origin *tétra* signifying four, and *chordé* a string, and if we take the natural scale of C we find it to be constituted of two perfect fourths, C to F, forming the first tetrachord, and G to C the second, which, taken together form the Diatonic scale. Two scales which have a tetrachord in common are termed relative scales. Every tetrachord belongs to two major scales, every major scale having one tetrachord in common with the scale which precedes it in the series of scales, and another tetrachord in common in that which succeeds it.

The ancient, strict, or contrapuntal style of harmony may be termed, or designated Diatonic, because in it no notes are employed which do not belong to the diatonic scale of the key major or minor, which may for the time prevail. This admits of diatonic notes only, subjects every note of the scale to the same laws, allows the 4th to the bass to be employed in no way but as a discord, admits of no unprepared discords except passing notes, and allows not passing notes to be approached by leap. Diatonic therefore consists of notes according to the signature of the key. The leading-note of the minor key, though indicated by an accidental sharp or natural, is diatonic, so also are the major 6th and minor 7th of the arbitrary minor scale.

When modulation occurs, the accidentals that denote the change of key are to be regarded as belonging to the signature of the new key, and thus are diatonic in the key to which the modulation is made. For example, a passage commences in the key of C and we wish to modulate into the key of G; the F sharp which induces such modulation is to be regarded as belonging to the signature of the new key, and thus is diatonic in the key of G. The modern, free or chromatic style of harmony admits of chromatic as well as diatonic notes; admits of exceptional treatment of certain notes, allows the fourth to the base to be employed as a concord, admits of fundamental discords, and allows passing notes to be approached by leap. It may also be well in this place to give a brief definition of fundamental discords. They are formed of the notes generated according to the natural system of harmonics; they are all derived from the dominant, the supertonic, and the tonic. Those belonging to the last two roots are all chro-

matic; those belonging to the first root are some chromatic and some diatonic; they require no preparation and have various resolutions. The word chromatic is of Greek origin, it signifies colored; a note or a chord either belongs to the key of the passage that precedes it or to the key of the passage that succeeds it; if that which preceeds it and that which succeeds it be both in the same key, this note, or chord, though foreign to the signature, induces no modulation, and is therefore chromatic. The phenomenon that every musical sound generates others, is the basis of the free or chromatic style of harmony. This phenomenon is demonstrable on every string, and every pipe of length sufficient and consequent depth of tone, for the ear to detect the more and more delicate sound of its generated notes, or harmonics as they are technically called, when they successively become evident to the perception. All wind instruments yield their harmonics, not together indeed, but successively to the stronger pressure of the player's breath, and those of the class of horns and trumpets have no other notes than their harmonic sounds, and the performer has no means of varying these but by the different manner in which he may direct his breath through the pipe.

Instruments of the violin class have also their harmonics which are produced by a mechanism totally different from that for intonating the consecutive notes of a scale. A cathedral, being a hollow form, is an enormous pipe, and this property which it possesses in common with the smallest wind instruments of giving out harmonic or generated sounds, must be the reason why early musicians, as a rule made their final closes upon a major chord, though the key of their piece were minor; since the major third is one of the most prominent notes of the harmonic series, so prominent indeed in buildings of great reverberation as to jar against the minor third if this be long sustained. We have but to extend further the inferential idea of smaller or larger vibrating media, and to follow this in thought into infinity, and we may willingly acknowledge the unmeasured concave of nature to be an immense musical instrument; when the Pythagorean doctrine of the music of the spheres will cease to seem a figurative image, a scientific myth, and will appear to ordinary comprehension but the statement of a fact, whose manifest evidence is within the reach of our senses. The whole system of chromatic or generated harmony is based on the following well established principles, viz: that the sounds of nearly every musical instrument with which we are acquainted are not, as they are ordinarily taken to be, single tones of one determinate pitch, but compound sounds containing an assemblage of such tones.

These are always members of a regular series, forming fixed intervals with each other; for instance, if we take C an octave below tenor C as a generator, the first overtone or harmonic audible is its octave, then the fifth above that octave, then the second octave or fifteenth above the generator, then the major third or two octaves and a major third above the fundamental sound, etc. This may be illustrated as follows: If a stretched string fastened at both ends, be caused to vibrate, communicating its vibrations to the air, the whole length of the string vibrates alone only momentarily; its divisions also vibrate, which produce cer-

tain sounds in rapid succession, superposed upon the principal sound, which sounds are called its harmonics or overtones, the sound produced by the vibration of the whole string being termed the generator. For example the vibration of the whole length of the string is followed by that of half its length which produces the 8th to the fundamental sound, then by one-third of its length, which produces the 5th, then by the one-fourth of its length, which produces the double 8th or 15th, then by one-fifth, producing the major 3d to that double 8th, etc., and by proceeding in this manner we learn that the major 3d and the minor 7th belong to the series of harmonics, and are thus naturally prepared whenever their generator is sounded; our singing or playing this combination of notes is then but a stronger articulation of sounds that are already vibrating in the air. The vibration-numbers of these overtones are connected by a simple law, which is readily deduced from the above relation.

Suppose the generating note to make 100 vibrations per second, two will make twice as many i. e. 200; (3) being a fifth above (2) will $=\frac{3}{2}\times 200=300$ vibrations; (4) being a fourth above (3) will produce $\frac{4}{3}\times 300=400$ for (5) $\frac{5}{4}\times 400=500$, for (6) $\frac{6}{5}\times 500=600$. The numbers therefore come out 100, 200, 300, 400, 500, 600. A sound may not contain all the overtone series, but never can a tone intermediate in pitch between any two consecutive members of the series make its appearance. Further evidence in support of this most important proposition may be enunciated, and in order to do this, the piano forte may be taken as one example. Let tenor C be first silently pressed down, and then C an octave below vigorously struck, and after a few seconds be allowed to rise again. The lower note is at once extinguished, and we now hear its octave sounding from the wires of tenor C, but if the damper fall back on these, by releasing the note hitherto held down, the whole sound is at once cut off. Next, by freeing the damper from the wire of the 12th or 5th above tenor C and pursuing a similar course a like result may be obtained, and so on for the 15th and the major and minor 3ds, but they fall off rapidly in intensity, and by this important fact we learn that the vibrations of any instrument are excited by resonance only when vibrations of the same period are already present in the surrounding air, and as the only sound directly originated in each variation of experiment was C and octave below tenor C this note must have contained the notes successively heard. The enharmonic is the third genus of which I have to treat, which with the Greeks comprised an interval less than the semi-tone, that is to say a note between E and F, higher in pitch than $E_{\flat}$ but not so high as F, and on keyed instruments it signifies the distinction between two notes of the same sound but having different names, as A flat and G sharp. The Persians for instance, divide their scale of an octave into eighteen sounds and the eastern and southern nations habitually intonate smaller intervals than semi-tones: whereas our modern scale is divisible into only twelve. Again in theory raising a note to its sharp means multiplying the number of vibrations per second of that note by the ratio $\frac{25}{24}$, which is the ratio of the number of vibrations per second of two notes at an interval of a minor semi-tone. To lower it to its flat on the other hand, means to multiply

the number of vibrations per second by the inverse ratio $\frac{24}{25}$. By example on the piano-forte it is necessary to add to the seven white keys of an octave seven black keys and not give as is done in practice: as raising to a sharp means rising through the interval $\frac{25}{24}$, and this interval does not exist in the simple musical scale. For illustration, between E and F there is an interval of a major semitone $\frac{16}{15}$. If E then be raised to its sharp a note is found, by rising through the smaller interval $\frac{25}{24}$, which is near F but lower; E sharp then does not coincide with F.

The foregoing remarks, which contain the truth, and nothing but the truth, though not the whole on the boundless subject here in part advanced, are based upon the teachings of some of our most eminent theorists of modern times, among whom I may mention the distinguished Professor of Music in the University of Cambridge, Sir George Arthur Macfarren, Mus. Doc. M. A., Principal of the Royal Academy of Music, and Sedley Taylor, Esq., M. A., Trinity College, Cambridge.

KANSAS CITY, MO., May, 1884.

DEATH OF BLACK-BIRD, THE OMAHA CHIEF.

OSCAR W. COLLETT, CUSTODIAN MUSEUM MO. HIST. SOCIETY.

The sixteenth annual report of the Peabody Museum contains a letter to which Prof. Putnam calls attention as of especial interest, written by Mr. Frank La Flesche, an educated Omaha Indian, relating to the history of his tribe, in which certain statements are made that seem to be inaccurate. According to Mr. La Flesche: "It is said that Black-Bird was buried with but very little ceremony, as he died when the Omahas were being very much troubled with the small-pox, and was *not* buried riding a live horse, as is stated by some. A grandson of his is still living, and is about a hundred years old; he cannot remember when his grandfather died, but thinks it was shortly before he was born." Mr. La Flesche then proceeds to assume, hypothetically, on the testimony of the grandchild and tribal traditions, that Black-Bird died more than a hundred years ago; and as the migrations of the Omahas northwardly "from near St. Louis" took place according to the same traditions, a century earlier, we are thus enabled to determine that these movements began a little previous to 1684.

An English naturalist who spent some time in the west during the first decade of the present century, in his journal of travel, gives the following account of Black-Bird:

"This chief, called by the French *Viseau Noir* (Black-Bird), ruled over the Mahas with a sway the most despotic. He had managed in such a manner as to inspire them with the belief that he was possessed of supernatural powers; in council no chief durst oppose him—in war it was death to disobey. It is related of him at St. Louis, that a trader from that town arrived at the Mahas with an

assortment of Indian goods; he applied to Black-Bird for liberty to trade, who ordered that he should first bring all his goods in his lodge, which order was obeyed. Black-Bird commanded that all the packages should be opened in his presence, and from them he selected what goods he thought proper, amounting to nearly the fourth part of the whole; he caused them to be placed in a part of the lodge distinct from the rest, and addressed the trader to this effect: 'Now, my son, the goods which I have chosen are mine, and those in your possession are your own. Don't cry, my son, my people shall trade with you for your goods *at your own price.*' He then spoke to his herald, who ascended to the top of the lodge, and commanded in the name of the chief, that the Mahas should bring all their beaver, bear, otter, muskrat, and other skins to his lodge, and on no account to dispute the terms of exchange with the trader, who declared, on his return to St. Louis, that it was the most profitable voyage he had ever made. Mr. Tellier, a gentleman of respectability, who resided near St. Louis, and who had formerly been Indian agent there, informed me that Black-Bird obtained his influence over his nation by means of arsenic, a quantity of that article having been sold to him by a trader, who instructed him in the use of it. If afterward any of his nation dared to oppose him in his arbitrary measures, he *prophesied* their death within a certain period, and took good care that his predictions should be verified. He died about the time that Louisiana was added to the United States; having previously made choice of a cave for his sepulchre, on the top of a hill near the Missouri, about eighteen miles below the Maha village. By his order his body was placed on the back of his favorite horse, which was driven into the cave, the mouth of which was then closed up with stones. A large heap was afterwards raised on the summit of the hill."

In another place is the following entry: "In the forenoon of this day (A. D. 1809,) Mr. Hunt was waited upon by two chiefs, who were contending for the sanction of the Government of the United States, to determine their claim to kingly power. Mr. Hunt declined interfering, not being vested with the power to act. The names of these two chiefs were Big Elk and White Cow, the former of whom ultimately succeeded."

At that time the range of the hunting grounds of the Mahas was from their village to *l'Eau qui Court,* and along that river.

Bradbury was a scientific botanist, made a voyage up the Missouri with Hunt and Liza in 1809, visited the Omaha village, and on his return spent the winter of 1809–10 in St. Louis. The occurrences of which he speaks were then so very recent as to be quite fresh in memory, and of public notoriety, and some persons at least, it may be assumed, had personal knowledge of the facts they imparted to the English naturalist; for this reason I am inclined to receive his account of Black-Bird's death and burial as trustworthy, and especially the approximate date given. Of course, if the topographical conformation of the bluff at the entrance to the cave is such that a horse could be led into the cavern, the chief was probably not entombed riding on his steed; but if the lay of the

land present no special obstacle, it appears to me the narrative as a whole should not be rejected.

But I think the date of Black-Bird's death can be determined pretty accurately. It is quite certain that Black-Bird was the great Maha chief with whom Clamorgan's fur company traded, and to whom Baron Carondelet, governor of Louisiana, sent medals and presents. But all this occurred during the year 1794 to 1796. According to Omaha tradition, as reported by Mr. La Flesche, the chief died during the year the tribe were so "much troubled with the small pox." But August Chouteau testifies that the small-pox made its first appearance in upper Louisiana, in the spring of 1801. This date is generally received as correct. The next year it began to spread among the Indians. The same naturalist, already quoted, writes: "In 1801, the Mahas were visited by the small-pox, which made dreadful havoc, and destroyed at least two-thirds of the whole nation." I find in all this sufficient proof to satisfy my mind that Black-Bird died in the year 1802.

As to the date when the Omahas began their migrations northwardly "from near St. Louis, assuming that they ever were there, I have no information. But it would seem that it may have been earlier than Mr. La Flesche supposes, as (whatever the testimony is worth,) I find on Marquette's Map 1673, (Shea's *fac simile*,) the "Maha" located in the interior on a line north of the mouth of the DesMoines River.

ST. LOUIS, MO., 1884.

DIRECTIONS FOR COLLECTING VERTEBRATE FOSSILS.

CHAS. H. STERNBERG.

The proper outfit for a collecting expedition consists of a good team of ponies or small mules, a light lumber wagon, cover, wall-tent, camp-stove or "Dutch oven," knives and forks, tin plates and cups, and other cooking-utensils. Each member of the party should be provided with a rubber blanket and coat, and a couple of pairs of woolen blankets; besides these but little extra baggage should be taken; a good pair of woolen shirts are valuable. The tools should consist of several small hand-picks, miner's-picks, with one point made into a duck-bill with sharp edge; butcher-knives, shovels and collecting-bags—made after the pattern of mail-carrier's bags, of heavy ducking with two apartments—one for cotton, paper and string, and the other for fossils. There should always be kept on hand a supply of burlap sacks, old newspapers, cotton, manilla paper and hop-needles; boxes and barrels for shipping.

A good saddle-pony is a valuable addition, as one can ride on ahead and choose a good camp or discover localities. When a camping-ground is chosen (which should of course, when possible, have wood, water and grass near at hand,) the first thing to be done is to pitch the tent, this is done by stretching it

out on the ground and staking down one side, the front flaps are then brought together and a stake driven in them, the other side and back are pinned down when the ridge-pole and uprights are put in, and the tent raised. Then the stakes for the walls are driven and the tent stretched by means of guy-ropes, when all is ready for the reception of the baggage. On making a bed a rubber blanket is first laid on the ground—rubber down—one pair of blankets are doubled length-ways and laid down and the other pair is used to cover the occupant. I find it valuable to have a narrow mattress of "excelsior," as it makes a most comfortable bed and adds but little to the weight on the road; mattress and blankets are rolled up and securely strapped.

On going into the field the collector takes a pick, butcher-knife and collecting-bag, with plenty of paper, string and cotton. When a specimen is discovered the first thing to be done is to collect all the fragments and dig up the debris for others which should all be carefully preserved. The rock above the specimen is then removed to within a short distance of the bones, and they are traced out by means of a butcher-knife. The bones should never be fully exposed, as the field is not the place to study anatomy. The idea of exposing a small portion of the bones is to show one where he can cut out his slabs. This is done by digging a trench the width of the pick three or four inches in depth, the slab is then loosened by striking carefully all around the specimen.

In packing, cover the exposed bones with cotton, the slab with dry grass and bind strongly with twine. Cover with burlap and sew securely. For packing in boxes put in plenty of dry grass in the bottom and put in the slabs on edge, tamp down grass between them and the edges of the box with a mallet and wooden spatula, have plenty of grass next the cover and bind the box with strap-iron.

When the bones are in loose sand great care should be exercised in laying bare the bones, not to remove any until all the limbs are uncovered, then make a sketch on strong paper, marking each bone and the corresponding one on the sketch. If the bones are broken in places mark a cross with colored crayon and make a sketch showing the breaks numbering all the sections which should be taken out separately and wrapped, the wrapper bearing a corresponding number.

Never attempt to take out a wet or damp specimen, as it will surely fall to pieces. All specimens should be allowed to lay exposed to the sun and wind as long as possible. Pack each limb (properly marked to correspond with sketch,) by itself. The skull should be wrapped in cotton and strong paper, and then carefully bound with strong twine. A burlap sack is then ripped open and plenty of dry grass laid over it, the skull is put in and the ends brought together and carefully sewed. The greatest care should be used in marking, each specimen should bear a tag with number, date, locality, formation and collection, and if it is necessary to use more than one sack have a similar label on each, be sure to wrap all fragments broken off with the bone to which they belong.

Fishes are among the most difficult specimens to preserve, the bones are very frail and splinter so badly that it is almost impossible to restore them. Where the upper surface is laid bare the bones should be carefully brushed off,

and one layer after another of strong paper pasted on until the necessary strength is given, then if the bones are loose turn them over and repeat the process—make a mucilage of gum Tragacanth.

Another good way, is to cover the specimen with two or three inches of plaster of Paris and allow it to set, this gives a fine protection to delicate bones. Never be in a hurry in collecting or searching for fossils. Go over the ground several times and remember that the less the specimen is exposed the more valuable will it be. In the Niobrara beds in summer go into the beds early and work until ten o'clock, and in the afternoon leave camp at half past two and work as long as you can see. You will find a pair of smoked glasses of value in collecting in hot weather.

In packing the specimens into boxes use great care. Never pack heavy and light specimens together. Mark each box with marking ink and number each. Under the cover put a card with description of contents, date, formation and collector. Always keep a note-book and record each day's work with description of specimens collected and notes on the stratigraphy of each formation with as many sections as possible.

The mode of mending specimens to prepare them for study is as follows: The matrix is first carefully removed, and the edges to be joined made perfectly clean. A cement made of glue, to which, when dissolved, plaster of Paris is added until it is of the consistency of thick cream is at hand, and when the pieces to be united are ready their edges are given a thin coat of cement with a brush, they are then pressed closely together and held a short time until the cement is hard when another piece is added, and so on until the bone is mended. Each specimen is labelled and a record kept.

THE CAUSE OF CHOLERA.

The London *Lancet* remarks that the epidemic of cholera in the south of France does more than maintain itself; it increases and it has diffused itself over a somewhat larger area. But for all that it is still a limited outbreak, and the hope that it may in the main be confined to the neighborhoods first attacked may perhaps be realized to a greater extent than was at first thought possible. So far, the rumors as to its extension to Paris and towns in other countries do not seem trustworthy, and hitherto no case has been brought into the United Kingdom. The *Lancet* gives a summary of a paper on cholera read on the 30th ult. before the Accademia Petraca of Arezzo, by Dr. Tommasi-Crudeli, whose researches on the bacillus malaria from a distinct advance in the etiology of intermittent fever. After tracing the history of the three great cholera epidemics that have visited Europe, he remarked that the disease was always an importation, never acclimatized like small-pox, and he defined it as a "contagio-miasma, a morbigenous germ, proceeding from a diseased human body, which never diffuses itself epidemically, except when the excretions containing it find in the soil conditions

favorable to the multiplication." Fillippo Pacini, of Florence, who died just a year ago, was, in 1854, the first to recognize the cause of cholera in a microscopic organism. This organism, according to Pacini, attacked the mucous membrane of the intestine; but his doctrine was ridiculed or disregarded till the other day, when the German Commission investigating the specific cause of cholera in Egypt and its native seat, the delta of the Ganges, came to the conclusion already arrived at by the Tuscan pathologist.

The cholera germ imported by patients, or their infected clothes, becomes epidemic only in countries presenting conditions favorable to its development. This development does not happen everywhere in the same mode, and in certain places it does not happen at all. When the disease has entered a country we cannot say whether it will take firm hold or not. We only know that its spread may be favored by four conditions: 1. Porosity of the soil in which choleraic dejections have been allowed to penetrate. 2. Oscillations of the underground waters by which the cholera miasm which has developed in the soil may reach the respirable atmosphere. 3. The accumulation of fæcal matters or of organic detritus infected by the germ. 4. The facilities offered to the diffusion of the germs in the drains, in the soil, in the air of the locality and in the drinking-water. Dr. Tommasi-Crudeli does not believe in sanitary cordons. They are as little able to keep cholera out of a province as custom houses are to prevent smuggling. Quarantine afloat he has more belief in, if properly carried out, without regard to the incubation period of cholera (eight days). But the sheet anchor of the prevention of cholera is the exclusion from the dwelling house and its inmates of the cholera germ. His counsels in this regard are similar to those of the English sanitary authorities—if possible a little more stringent as to the washing with disinfectants of all linen, whether visibly fouled or not with fæcal matter. As to prescribing a diet different from what suits the individual in ordinary health, he ridicules the notion.

EDITORIAL NOTES.

THE 33d meeting of the American Association for the Advancement of Science, will be held at Philadelphia, September 4th to 10th. It is held at a later date than usual for the purpose of giving the members an opportunity to exchange courtesies with the British Association which meets in Montreal August 27th. At the same time the International Electrical Exhibition will be in session at Philadelphia, also the American Institute of Mining Engineers and the Pennsylvania Agricultural Society. It is probable that while the members of the British and American Associations are enjoying each others' society at Philadelphia, steps will be taken towards organizing an International Scientific Association. This will doubtless be the most largely attended meeting of the association, and extensive arrangements are being made to accommodate and interest all visitors. All communications concerning rooms and other local matters should be addressed to Prof. H. Carvill Lewis or Dr. Edward J. Nolan,

Secretaries of the Local Board at Philadelphia. All official enquiries to Prof. F. W. Putnam, who will be at Salem, Mass., until August 20th, after that date at Hotel La-Fayette, Phildelphia.

THE Brighton Electrical Railway, a suburban road at Brighton, England, about one mile long, appears to be a success. Its average earnings are stated to be over £34 per week and its expenses and interest only £18, leaving a net profit of £16 per week. It has at present only one car, which runs about eighty-two miles per day, seats thirty passengers, and makes a speed of eight miles per hour.

CHICAGO parties are said to have purchased land in Iron and Reynolds Counties, this State, and a stock company with a capital of $250,000 has been organized for iron and silver mining. They have already purchased over 1,000 acres of land, and have contracts for nearly 3,000 more. An expert mining engineer from Pennsylvania has been employed and will have charge of the development of the property. Another company with a capital of $50,000 is being organized to quarry marble and granite on the Black River.

DR. CARLOS FAREMBA, of Mexico, has addressed a circular letter to all representatives of foreign governments now in Washington, advocating the celebration of the discovery of America on its 400th anniversary, October 12, 1892, and the erection of a monument on the spot where the first landing was made.

DR. JOSEPH HALL, President of the New Orleans Board of Health, states that, after the most fair and unlimited trial, carbolic acid has proved a failure as a general disinfectant, and especially in yellow-fever. In its place he has adopted bi-chloride of mercury, which costs only about 80 per cent as much, and is in his opinion the most powerful germicide known, and at the same time it is free of all unpleasant smell and color. The standard solution will be six ounces of the mercury and four ounces of muriate of ammonia first dissolved in a half gallon of water and then added to forty gallons of water.

THE State Natural Historical Society of Illinois held its annual meeting at Peoria, July 7 and 8, 1884. An address was delivered by the President Dr. Julius S. Taylor, of Kankakee. Papers were read by Hon. Wm. McAdams, Prof. S. A. Forbes, A. B. Seymour, A. H. Mundt, and others. An excursion was also taken up the Illinois River for field work and a pic-nic, which was much enjoyed by all. An election of officers was held just before returning, at which the Hon. Wm. McAdams, of Alton, was made President for the ensuing year, and S. A. Forbes, Secretary; Prof. Burrill and Mr. J. E. Armstrong were made Vice Presidents. Tylor McWhorter was elected Treasurer and Dr. Edwin Evans and Mr. A. H. Mundt were chosen as additional members of the Executive Committee.

AT Cleveland, Ohio, Mr. Walter Knight has succeeded in perfecting a plan for running street cars by electricity. Last week a mile of track was prepared for it and forty persons were carried for as many trips over the road at a rate of speed ranging from one to fifteen miles an hour, at the will of Knight, the inventor. The plan being considerably cheaper in its working than the old way and as any number of cars can be placed on the circuit to run independent, the East Cleveland line will adopt it and will immediately make the necessary arrangement.

IT is proposed to organize, under the auspices of the American Social Science Association, during its next annual session at Saratoga, September 8-22, 1884, an American Historical Association, consisting of professors, teachers, specialists, and others interested in the advancement of history in this country. Friends of history can profit by association with one another and also

with specialists in the kindred subjects of Social Science, Jurisprudence, and Political Economy, which are represented at this annual meeting in Saratoga. By conference with co-workers historical students may widen their horizen of interest and cause their individual fields of labor to become more fruitful. The leading spirits in this movement are Prof. Jno. Eaton, Prof. F. B. Sanborn, Prof. C. K. Adams, Prof. M. C. Tyler and Prof. H. B. Adams.

THE American Wood Preserving Company have been awarded the city contract for paving Chestnut Street, St. Louis, from Jefferson to Grand Avenue with gum lumber treated by the zinc-gypsum process.

DR. LEWIS SWIFT, director of the Warner observatory, has received intelligence of the discovery of a comet by Prof. E. E. Barnard, of Nashville, on the night of the 19th instant, and the discovery was verified by the motion of the comet the next night. It is in the head of the Wolf, right ascension 15h., 50 m., and 30s., declination south 17° 10′, and is moving slowly in an easterly direction. It seems to be growing brighter, and is probably coming toward the earth. This is the first comet discovered in the northern hemisphere this year.

ITEMS FROM PERIODICALS.

Subscribers to the REVIEW *can be furnished through this office with all the best magazines of this Country and Europe, at a discount of from* 15 *to* 20 *per cent off the retail price.*

To any person remitting to us the annual subscription price of any three of the prominent literary or scientific magazines of the United States, we will promptly furnish the same, and the KANSAS CITY REVIEW, *besides, without additional cost, for one year.*

THE August *Harper's* is especially noteworthy for its papers on American places—"The Gateway of Boston," in which W. H. Rideing describes and Messrs. Halsall and Garrett picture Boston Harbor; Salt Lake City, described by Ernest Ingersoll, with fifteen illustrations; and Richfield Springs, a paper with special reference to their medicinal waters, by F. J. Nott, M. D. Mr. Boughton will continue his chatty "Artist Strolls in Holland" in company with Mr. Abbey. Art will be represented by a paper on the work of the "Associated Artists" by Mrs. Harrison, with charming illustrations of the needlework designs of Mrs. Wheeler, Miss Dora Wheeler, and others, as well as by the frontispiece reproduction of Mr. Dewing's rose-painting, "A Prelude;" sport, by "Antelope Hunting in Montana," with illustrations by Beard and Frost; history, by the first of a series of brilliantly written and illustrated papers on "The Great Hall of William Rufus," by Treadwell Walden. William Black's and E. P. Roe's novels will have their usual superb illustrations by Abbey, Gibson, and Dielman, and more of the charming landscape illustrations by Alfred Parsons will accompany a further installment of Mr. Sharp's poem-pictures, "Transcripts from Nature." There will also be stories and poems by Mrs. Macquoid, Mr. Bynner, Lucy Larcom, Mrs. Fields, and others. A paper on "The Building of the Muscle" will be contributed by Julian Hawthorne. Among Mr. Curtis's topics in the "Easy Chair" are National Conventions and College Commencements.

THE *Magazine of American History* for August comes laden with a variety of agreeable surprises. It will attract many readers. The opening article, "The Story of a Monument," by S. N. D. North, of the *Utica Herald*, is a timely production, and of curious interest to the public in general. The illustrations add greatly to its value, of which is the fine portrait of Ex Governor Horatio Seymour—frontispiece to the magazine. The next article introduces a learned discussion of the new and novel question, "Did the Romans colonize America?" The author, M. V. Moore, foreshadows futher papers, and from the masterly skill with which he handles the subject they will naturally excite wide attention.

THE *North American Review* for August contains an article by Justice James V. Campbell on "The Encroachments of Capital," which will command the serious attention of all readers. Richard A. Proctor treats of "The Origin of Comets," and succeeds in presenting that difficult subject in a light so clear that persons who have little or no acquaintance with astronomy can follow his argument. "Are we a Nation of Rascals?" is the startling title of an article by John F. Hume, who shows that states, counties and municipalities in the United States have already formally repudiated, or defaulted in the payment of interest on an amount of bonds and other obligations equal to the sum of the national debt. Judge Edward C. Loring finds a "Drift toward Centralization" in the recent judgment of the United States Supreme Court on the power of the Federal Government to issue paper money, and in the opinion of the minority of the same court rendered in the suit for the Arlington property. Julian Hawthorne writes of "The American Element in Fiction," and there is a symposium on "Prohibition and Persuasion," by Neal Dow and Dr. Dio Lewis.

THE *Atlantic Monthly* for August has the following attractive table of contents. In War Time, XV., XVI., S. Weir Mitchell; Carpe Diem, E. R. Sill; The Twilight of Greek and Roman Sculpture, William Shields Liscomb; The Zig Zag Telegraph, Lloyd G. Thompson; The Rose and the Oriole, Thomas William Parsons; A Cook's Tourist in Spain, II; Dinky, Mary Beale Brainerd; Nathaniel Parker Willis, Edward F. Hayward; The Edda Among the Algonquin Indians, Charles G. Leland; The Thunder-Cloud, James T. McKay; Bugs and Beasts before the Law, E. P. Evans; An Old New England Divine, Kate Gannett Wells; The Anatomizing of William Shakespeare, III. Richard and Grant White; Where It Listeth, Edith M. Thomas; Lodge's Historical Studies; A Modern Prophet; The Contributors' Club; Books of the Month.

THE *Popular Science Monthly* for August is promptly on hand. The contents are as follows: Hickory-Nuts and Butter-Nuts, by Grant Allen; The Ghost of Religion, by Frederic Harrison; Retrogressive Religion, by Herbert Spencer; Some Rambles of a Naturalist, by Charles C. Abbott, M. D.; Scientific Philanthropy, by Lee J. Vance, B. S.; The World's Geyser Regions, by A. C. Peale, M. D.; (Illustrated.) Reparation to Innocent Convicts, by Dr. Henrich Jaques; The Chemistry of Cookery, by W. Mattieu Williams; My Monkeys, by M. J. Fisher; The Salt-Deposits of Western New York, by Frederic G. Mather; The Morality of Happiness, by Thomas Foster; The Mystic Properties of Numbers, by Etienne de la Roche; Sketch of Professor Felipe Poey, by Professor David S. Jordan; (With Portrait.) Editor's Table; Science and the Temperance Reform; Literary Notes; Popular Miscellany; Notes.

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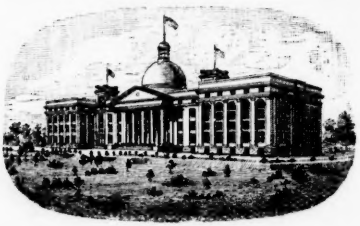

COLUMBIA, - MO.

The Academic, Agricultural, Normal and Engineering Schools will open the 2d Monday (8th) of September, 1884. The Law and Medical Schools will also open September 8th.

THE DEPARTMENTS OF INSTRUCTION ARE:

1. The Academic Schools of Language and Science.
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Board in private families, $3.00 to $4.50, and in clubs at about two-thirds of these rates.

In the means of instruction and illustration, none of the institutions of learning in Missouri have superior advantages. The association of the several schools with each other is deemed a circumstance of decided advantage. When, for example, a student has entered the Law or Medical School, he has access to all the departments of Academic instruction without any additional expense.

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SAMUEL S. LAWS, President.